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TANDY®

1200-Bps Intelligent Modem DCM 212

OPERATION MANUAL

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Introduction

Tandy's DCM 212 1200-bps Intelligent Modem has all the features needed to enhance your data communications applications — including a data output rate four times faster than that of a 300 bits/second modem.

This direct-connect, Bell 103/212A type modem is not only designed with standard automatic dial, answer, and disconnect features, but also with a wide range of system configuration enhancements as well. Its CPU provides operation in both Tandy and Hayes® protocol modes — each selectable at the flip of a DIP switch. In the Hayes protocol mode, your Modem is AT-compatible and capable of running with Hayes software.

After dialing a phone number, the DCM 212 will monitor the call and report its progress to your computer over the serial RS-232C link. You can even control the dialing method — pulse or touch-tone — and the number of times the phone should ring before being answered.

These functions and others are controlled by ASCII (American Standard Code for Information Interchange) encoded commands that you program from your computer keyboard over the serial RS-232C interface. Roughly equivalent to a telephone operator making a call, the DCM 212's features include:

- Waiting as the phone rings until the dialed number is answered
- Hanging up and redialing later if the number is busy, or if the call has not been answered after a specified period of time
- Hanging up the handset at the end of a completed call

One of the DCM 212's more advanced features is the ability to determine your computer's communications parameters (bit rate, data bits per word, parity, and stop bits per word), and to adjust its own operation to meet system requirements using a simple command code sequence.

Incorporating a high degree of intelligence, the DCM 212 allows you to operate your computer virtually unattended when linked to a telephone, making possible a wide range of telecommunications applications. Used with the proper applications software package, the Modem is capable of performing operations such as electronic mail and shopping, central-data-base access, home banking and remote-peripheral sharing.

Another feature of the DCM 212 is a built-in monitor speaker which enables you to monitor audibly the dialing and data communication progress. The situation is reported visually on your display with messages called results codes.

Sample programming sessions are provided in each section of this manual to help familiarize you with the various functions of the DCM 212 and to get you started using your Modem as quickly as possible. After you have become familiar with the manual and your Modem, the handy Quick Reference Card should keep you “up-and-running!”

Description of the DCM212 1

When power is first applied, several indicators on the DCM 212's front panel will illuminate — and remain lighted, depending on the status of the computer's protocol and DIP switch settings. These 7 indicators show the Modem's internal and external operation status.

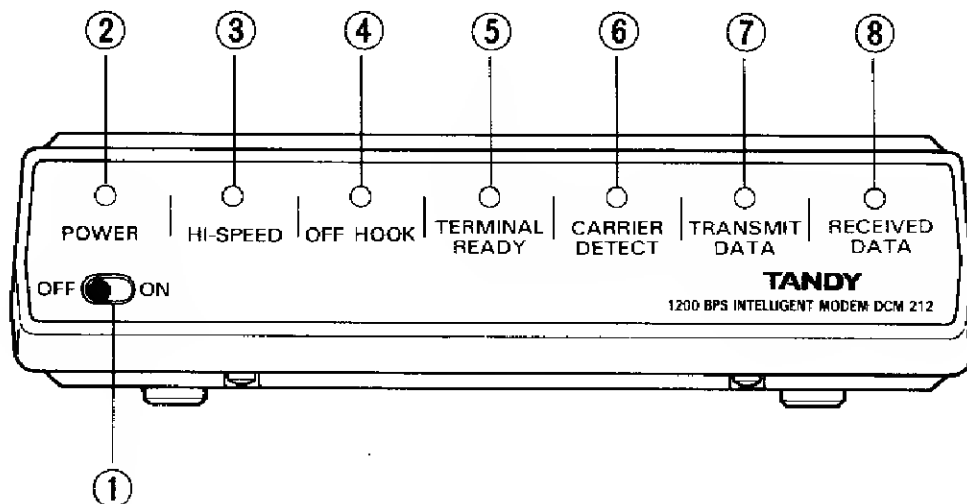


Figure 1. Front Control Panel

- ① **Power switch** turns the Modem ON or OFF. Be sure to turn it OFF when the Modem is not being used.
- ② **POWER indicator** lights when power is on.
- ③ **HI-SPEED indicator** lights when the Modem is in high speed (1200 bps) communications.
- ④ **OFF HOOK indicator** lights when the Modem is ON LINE (connected to the phone line).
- ⑤ **TERMINAL READY indicator** lights when the terminal is supplying DTR (Data Terminal Ready).
- ⑥ **CARRIER DETECT indicator** lights when the Modem receives a carrier tone or generates a false carrier.
- ⑦ **TRANSMIT DATA indicator** blinks when the Modem is transmitting data.
- ⑧ **RECEIVED DATA indicator** blinks when the Modem is receiving data.

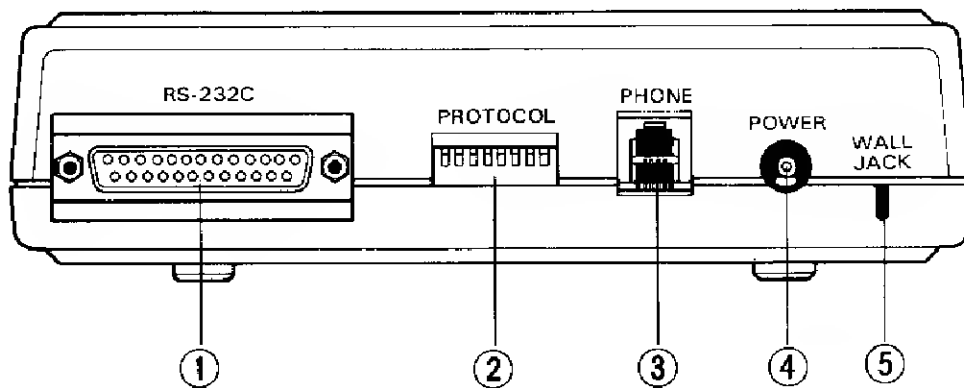


Figure 2. Rear Panel

- ① **RS-232C standard DB-25 jack** connects the Modem to the RS-232C interface of your computer.
- ② **PROTOCOL (DIP) switches** control the Modem's power-up condition (refer to **PROTOCOL (DIP) switches** later in this section).
- ③ **PHONE jack** connects the telephone to the Modem.
- ④ **POWER jack** connects the Modem to the AC power adapter.
- ⑤ **WALL JACK phone line cord** connects the Modem to the telephone line.

Before you connect the DCM 212, **first** read the instructions in Appendix C, **Connecting the DCM 212**. Be sure to turn OFF power to the Modem and to the computer!

Typical connection

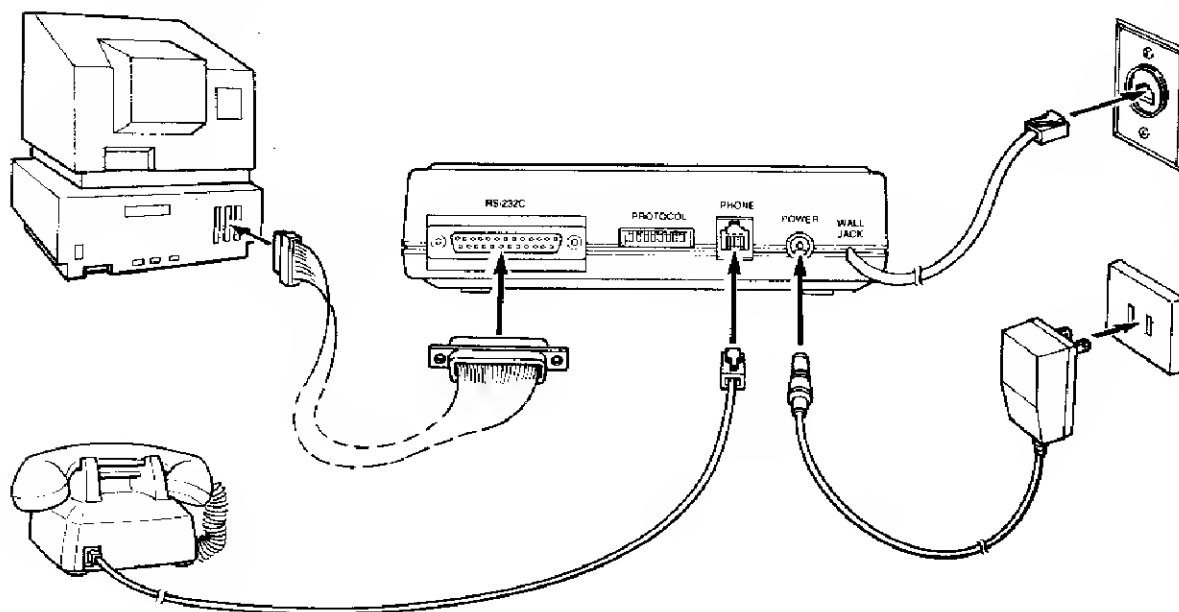


Figure 3. A Typical Connection

High and low speed operations

The DCM 212 Modem automatically synchronizes with standard speed rates of 300 and 1200 bits per second (bps).

Switching from high speed (1200 bps) to low speed (300 bps) operation occurs when the DCM 212 receives either the wake-up code in the Tandy protocol mode, or the attention code in Hayes protocol mode. When the Modem detects 1200 bps after receiving the code sequence, it will communicate in high speed. If it is awakened at 300 bps, low speed operation will be used.

The originating station always determines the speed of operation. If you wake up the DCM 212 in low speed mode intending to call a high speed modem, the DCM 212 will select 300-bps operation none the less if that modem has low-speed detection circuitry. Otherwise, the DCM 212 **must be set to high speed** before calling a remote modem.

PROTOCOL (DIP) switches

DIP switches control the DCM 212's power-up condition. These switches must be set before you turn the power ON.

First, you will have to decide whether you want to use the Modem in the Tandy protocol mode or Hayes protocol mode. If you are using Tandy communications software, you will want to set it for Tandy protocol. For use with Hayes communications software, set it to the Hayes protocol mode. (Both the Tandy 1000 and 1200 personal computers can be used with either communications software.)

Tandy Protocol

When you select Tandy protocol mode, set Switch 2 to OFF. Figure 4 shows an example of the suggested switch positions.

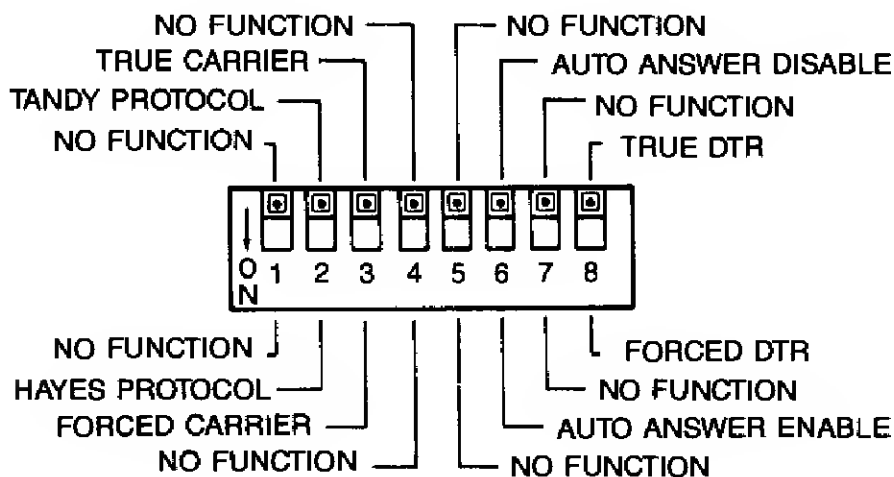


Figure 4. DIP Switch Settings in Tandy Protocol Mode

Notes:

1. When Switch 3 is ON, the G command (software control for FCD) is disabled and the FCD (Forced Carrier Detect) signal is issued to the terminal as long as the Modem is ON. When the switch is OFF, the FCD signal can be software-controlled by the G command and the parameter FORCE CARDET= shows the FCD signal condition. The CD indicator reflects true carrier status when the FCD signal is OFF.
2. When Switch 6 is ON, the Modem assumes auto-answer mode with 1200 bps. Be sure to set your Computer to 1200 bps before turning the Modem on.

Table 1. DIP Switch Settings in Tandy Protocol Mode

SW	Position	Function
1	Should be OFF	No function
2	Should be OFF	Set the Modem to Tandy protocol mode.
3	ON	Forced carrier detect. Modem issues an FCD signal to computer upon power-up.
	OFF	True carrier detect. FCD signal can be turned on and off with the G command, under software control.
4	Should be OFF	No function
5	Should be OFF	No function
6	ON	Auto-answer mode enabled
	OFF	Auto-answer mode disabled
7	Should be OFF	No function
8	ON	Forced DTR. Modem accepts commands from computer any time without a DTR (Data Terminal Ready) signal.
	OFF	True DTR. Modem is OFF until it receives a true DTR signal from the computer.

Hayes Protocol

When you want to use your DCM 212 in Hayes protocol mode, position Switch 2 to ON. In this protocol mode, the other switches function differently from those in Tandy protocol. Figure 5 shows which switch settings can be used for easy operation.

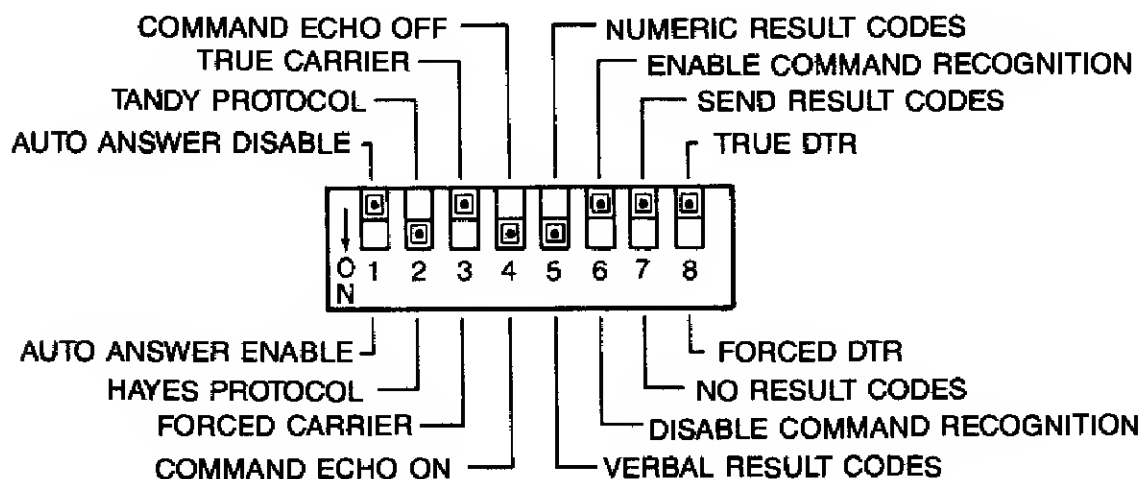


Figure 5. DIP Switch Settings in Hayes Protocol Mode

Note: When Switch 1 is ON, the Modem assumes auto answer in 1200-bps operation.

Table 2. DIP Switch Settings in Hayes Protocol Mode

SW	Position	Function
1	ON	Auto-answer mode ON
	OFF	Auto-answer mode OFF
2	Should be ON	Sets the Modem to Hayes protocol mode.
3	ON	Forced carrier detect
	OFF	True carrier detect
4	ON	Command echo ON (echoes command characters to verify that the Modem accurately receives the commands sent to it).
	OFF	Command echo OFF
5	ON	Displays verbal result codes.
	OFF	Displays numerical result codes.
6	ON	Disables command recognition. Modem does not recognize commands.
	OFF	Enables command recognition. Modem recognizes commands.
7	ON	Result codes disabled (disables Switch 5)
	OFF	Result codes enabled (enables Switch 5)
8	ON	Forced data terminal ready signal
	OFF	True data terminal ready signal

Communications protocol

The following criteria must be met before computer-to-computer communication can occur.

- Both computers must have the same communications protocol:

Operation speed (300 bps or 1200 bps)

Word length (7 bits or 8 bits)

Parity (even, odd or none)

Number of stop bits (1 or 2 bits)

See your computer owner's manual for instructions on setting the communications protocol.

When opened for programming by the wake up or attention code sequence, the DCM 212 will automatically synchronize the speed rate, word length, parity, and stop-bit numbers (communications protocol) of your computer system.

2. One modem must be in originate mode and the other must be in answer mode. Usually, when you call another computer, you should be in originate mode. When you receive a call, you should be in answer mode.

Manual v. automatic operation

When you want to dial an information service (such as CompuServe or Dow Jones) or communicate with another person whose computer is also using VIDTEX, set the Modem to manual operation mode. In this mode, you can control what the system does by manually dialing and answering the phone.

When you want the DCM 212 to dial a phone number or answer the phone for you, set it to automatic operation mode. In this mode, the Modem dials the phone number you store in its memory or answers the phone when someone calls you. Automatic mode, for instance, lets you dial the information service number without picking up the phone — just type the number along with the proper DCM 212 programming commands on the computer keyboard.

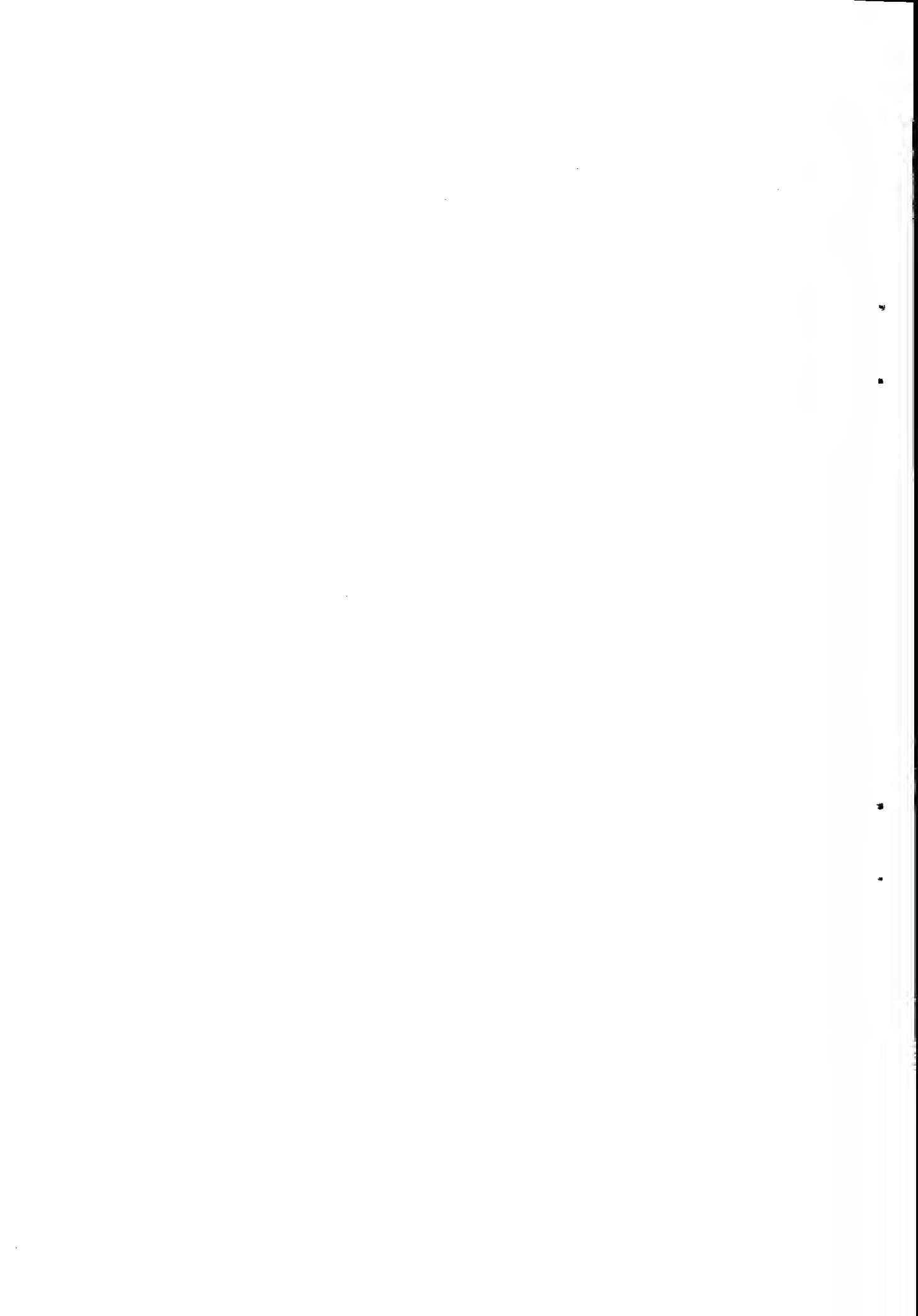
Originate v. answer mode

To place a call to an information service or another person using VIDTEX, set the DCM 212 to originate mode. In this mode, the call originates from your computer. When you want to receive a call (answer the phone), set the DCM 212 to answer mode. Note that originate and answer modes can be used either manually or automatically.

Helpful Tip:

When you use your DCM 212 for the first time or when you seem to be getting garbled data, use the self-test mode to help you find the cause of the problem. Refer to the section on "self-test" in Appendix A, **Tandy protocol reference**, or in Appendix B, **Hayes protocol reference**.

If you plan to use the DCM 212 in Tandy protocol mode only, you may skip Chapter 3 and Appendix B. However, if you intend to use it in Hayes protocol mode only, you may disregard Chapter 2 and appendices A and D. Refer also to the operation manual which accompanies your communications software package.



Tandy protocol mode operation 2

This chapter will give you an idea of what the DCM 212 can do in the Tandy protocol mode. The Videotex Plus communications package for Tandy's Model II, 12, 16 and 6000 microcomputers is used in the sample sessions following. With this package you can communicate with a variety of information services and host computer systems. The examples will help familiarize you with some of the operations the Modem is capable of performing.

If you are using an MS-DOS operating system, feel free to move to the auto logon session using DeskMate's Telecom in Chapter 3, **Hayes protocol mode operation**. XENIX® users may want to skip to Appendix D.

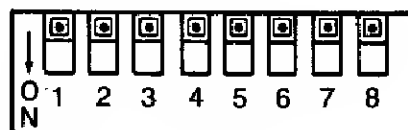
For a detailed discussion of all the available commands in Tandy protocol, refer to Appendix A.

Sample programming sessions

All Modem functions are controlled by ASCII encoded commands that you send from your computer keyboard. Use the wake-up command **(*) (.)** to open the DCM 212 for programming.

When this 2-key code sequence is issued, the DCM 212 automatically adapts the communications protocol (speed, word length, parity, and stop bits) of your computer.

1. Check again that all peripherals are correctly connected and receiving power.
2. Set the DIP switches as follows:



3. Flip the power switch on the Modem's front panel to the ON position.
4. Load and run the Videotex Plus communications program as described in your user's guide.
5. At TRSDOS Ready, type VIDTEX **(ENTER)** . *TERMINAL READY indicator lights.*

Tandy protocol mode operation

6. Set the communications protocol (bit speed, word size, parity, and stop bits) that you want to use.
7. Open the DCM 212 Modem for programming by typing the wake-up command sequence. Press ☐ * ☐ .

You may have noticed that the * did not echo until you pressed ☐ . That's because both keys are needed to determine the bit speed rate. When the correct operation speed is detected, the character * (HEX '2A') is output.

The Modem is now in the command receptive state and is waiting for you to begin programming or setting the internal switches that will tell it what operations are to be performed.

8. When the * echoes on your computer screen, press ☐ L for the LIST command to display or list the Modem's current parameters. When cold-started, the list shows:

```
PHONE NO:
10 BITS/CHAR:Y
ABORT CHAR:14H
LOSS OF CARR:Y
SEND SPACE:N
RECEIVE SPACE:Y
ABORT ENABLE:Y
HIGH SPEED:Y
ANALOG LOOP:N
ORIG MODE:Y
MANUAL MODE:N
FORCE CARDET:Y
PULSE DIAL:Y
SLOW DIAL:Y
```

After the parameters are listed, the Modem returns to the command receptive state where it waits for further instructions.

Note: The above list appears when you select high speed mode at step 6. If you select low speed mode, the 2nd line (10 BITS/CHAR:Y) is not displayed and 8th line changes to HIGH SPEED:N.

CompuServe logon

CompuServe Information Service is widely known for its numerous on-line services for both business and home computer owners. Dedicated telephone numbers in major cities provide you access to CompuServe. Use your information service user's guide to find out how to contact and use the service.

Since the DCM 212 is already in the command receptive state — waiting for your command — all you have to do to begin the logon is prepare it to dial the information service access number.

1. Press **(D)** to place the Modem in the dialer programming mode. For example, if you enter (111)555-1234 as your local 1200 bps access number, the sequence appears as:

```
D(111)555-1234
```

2. When the phone number is properly formatted (see D command, **Tandy protocol reference**), press **(X)** to force the Modem to execute the switches and seize the telephone lines and to begin dialing the number. *OFF HOOK indicator lights.*

The screen shows:

```
DIALING... 1115551234
```

3. When the dialing has been made successfully, the screen shows:

```
CONNECT 1200
```

If you have selected low speed mode operation, the screen shows **CONNECT**.

Dialing . . . and connect are the **result codes** (discussed later in this section) which keep you informed of the status or progress of a phone call. If you received a ? instead of the message shown, you probably entered a key that the Modem did not recognize.

4. Press **(CTRL) (C)** and type the User ID number that you received with the software package when the screen prompts:

```
User ID:
```

Tandy protocol mode operation

5. Next, type the password that you received with the software package when the display prompts:

Password:

Your password is not printed on the screen to retain its secrecy. At this point, your logon to CompuServe is complete and you may begin using the service. To use other information services and host systems, simply substitute the appropriate dialog as provided in the information service user's guide.

Answer or originate a call automatically

When communications with the information service is completed, the Modem reverts to the disconnect mode. To program the Modem to monitor the telephone lines for incoming calls, enter:

* ,	Wake up!
A	Select answer mode.
X	Do it!!!

The Modem prompts the screen by sending the message WAITING FOR RING and waits for the telephone to ring.

To change the operation mode from auto-answer to auto-originate again, assuming no other call has been made and the Modem is waiting for the telephone to ring, press ☐ to turn OFF the call waiting mode. Then program the Modem to dial (originate) a number by entering:

O	Select originate mode.
X	Do it!!!

OFF HOOK indicator lights. The Modem seizes the phone line and begins dialing the access number that you used earlier. Any number entered in the dialer memory will remain intact until a new number is entered or the Modem is turned OFF. When the call is completed, the Modem goes back OFF LINE and communication ends with the DISCONNECT prompt.

Answering and originating calls automatically are discussed in more detail in the section **Automatic mode operations**.

Advanced programming options

When the DCM 212 detects a busy signal after dialing a number, the message BUSY is printed on the screen. (*The Modem enters the disconnect mode.*) With the Modem programmed to redial a number found busy, the second attempt is made after a 60-second delay. This cycle — disconnect, wait, redial, disconnect, wait, . . . — will continue until the number of programmed attempts is completed, or until you abort the process with the * command.

To change the default dial attempts setting, follow these steps:

* ,	Wake up!
I	Bring the advanced programming options to the screen.

1. Press **ENTER** . The DIAL ATTEMPTS prompt appears on the screen.

DIAL ATTEMPTS:1?

2. Change the default number to a value other than 1 by typing in that new number. Press **ENTER** (6 times) until you have scrolled through all the options and exited the menu.
3. Press **D** , enter the phone number to be dialed, and press **X** .

As you might have noticed, *I* command has 7 other options in addition to the dial attempt setting. For more information, refer to *I* command in Appendix A.

Manual mode operations

When operating in manual mode, you control the system by manually dialing and answering the telephone. Manual mode (answer or originate) is useful when you want to talk by telephone to a friend at a remote location and later exchange computer data without redialing.

Example 1: Manual answer mode

The phone rings and you answer by picking up the receiver. After talking a while to your friend, you decide to exchange information by computer (telecommunications) without breaking voice call:

1. Your friend selects to be the originating station, while you are the answering station. You may recall that automatic originate mode is a preset condition at initial power-up, so you must set up your Modem by entering:

* ,	Wake up!
M	Select manual mode.
A	Select answer mode.

2. Give your friend time to set up the originate modem.

3. Press **(X)** . The Modem transmits a carrier tone.

The carrier is the sound you hear through the built-in speaker or when you pick up the receiver while the Modem is in communications with another modem. It sounds similar to running water or static during high speed operation and is a steady, pure tone during low speed operation.

4. The answer station always issues the *X* command first. After hearing the answer modem's carrier tone, the originate station sends the *X* command to complete the connection and the screen prompts:

CONNECT 1200 (or CONNECT in low speed mode)

Hang up both handsets.

Be sure to keep quiet when the handset is OFF HOOK — noise picked up could cause errors in the data being passed by the modems.

Also, be careful when you hang up the telephone since slamming or dropping the phone back on the hook while the modems are controlling the lines could disrupt carrier long enough to start a loss-of-carrier disconnect sequence.

To return to voice communications after transmitting data:

1. Carefully pick up the handsets (both modems).
2. Type at the keyboard that you will be aborting carrier. For example, you might signal your friend by typing:

THAT'S ALL! I AM ABORTING CARRIER.

3. After making sure your handset is OFF HOOK, enter the abort character **CTRL** **T** to force the Modem OFF LINE.

After 3 seconds of inactivity, your Modem logs out with the DISCONNECT prompt and your friend's modem (if automatic) shuts down, too.

If your computer does not have the CTRL key, refer to your computer manual to find out the key of hex value 14, or change the abort character using abort character redefinition @. Refer to Appendix A, @ command.

Example 2: Manual originate mode

1. Assume your friend selects answer mode this time and you have to set your Modem to originate mode. First, return the DCM 212 to command receptive mode, then check the current parameters:

```
* ,      Wake up!
L        List current parameters
```

2. The mode parameters should show:

```
ORIG MODE:Y
MANUAL MODE:Y
```

If not, change the parameters by pressing **O** (originate mode) and **M** (manual/automatic toggle).

3. Wait for the carrier from the answer modem. When you hear it, press **X**. The screen prompts:

```
CONNECT 1200
```

Continue by following the procedures in Example 1.

Automatic mode operations

The DCM 212 can be programmed to make a call or answer your telephone automatically. In the automatic mode operation, you can call an information service without picking up the phone — just type in the phone number on your computer keyboard. You can also tell the Modem to auto-answer your telephone.

Example 3: Automatic answer mode

1. To program your DCM 212 to answer incoming calls, press ***** **.** to wake up the Modem, then press **A** to send the answer command. Remember, if this is a cold start-up, the DCM 212 will default to automatic originate mode and you will need to press **A** to select answer mode. The display shows:

*A

To check that all the parameters are set correctly, press **L** for the list command and look for the ORIG MODE and MANUAL MODE parameters. Then, press **X** to force the Modem to seize the phone line.

2. The Modem prompts WAITING FOR RING and waits for the telephone to ring.
3. When the phone rings, the Modem begins counting the rings and the screen shows the message RING for each ring. After 2 rings, it answers by seizing the telephone line and asserting carrier. The calling modem replies with its carrier. Then the screen shows:

CONNECT 1200

The modems are now in ON-LINE status and telecommunications can begin.

When the Modem does not receive a valid tone from the other Modem within 30 seconds, it aborts the call and sends the message NO CARRIER. The DCM 212 then returns to the auto-answer mode.

If you break the connection after a successful data exchange, the DCM 212 sends the message DISCONNECT. If the modem at the other end breaks the connection, the DCM 212 alerts you by sending the message NO CARRIER. In either case, the DCM 212 returns to the auto-answer mode and monitors the line.

Regardless of the number of calls received and the number of calls that transferred computer data to your system, the DCM 212 will always return to the call-waiting state. You can turn OFF this call-waiting mode by pressing ***** (**.** is not needed). When the Modem detects the ***** (***** will not be echoed), it will return to the command receptive state.

Note: The parameters are still not changed! If you want to return to the auto-answer mode, send the *X* command. If you want to make an outside call, press **O** (originate mode) to take the Modem out of the answer mode.

The ring number is set to 2 at power-on. This means your Modem will seize the phone line after 2 rings. When you want to change this number, use the *I* command.

Example 4: Automatic originate mode

When you want to call another modem, but do not want to dial it yourself, you can program the DCM 212 to dial in auto-originate mode.

1. Press ***** **.** to wake up the Modem. When cold-started, the Modem defaults to automatic originate mode. Press **L** to check the Modem's current parameters. These commands echo as **L*.

If your listing does not show *MANUAL MODE:N* and *ORIG MODE:Y*, press **M** and/or **O**.

2. Enter the *D* command to program the dialer memory — that is, tell the Modem what number you want to dial. After typing in the phone number, press **X** to force the Modem out of command receptive state and to begin dialing the number.

When the *X* command is received, the DCM 212 outputs a carriage return and line feed. Then, it seizes the telephone line and outputs to the computer:

DIALING . . . *telephone no.*

Each number dialed is flashed on your screen in the sequence and speed specified. See **Programming commands** in Appendix A for fast and slow signaling rates.

3. When the carrier tone is heard, the Modem sends the message:

CONNECT

When the DCM 212 reaches the end of its programmed dialer memory, another carriage return/line feed is issued and the Modem's line status circuitry checks the progress of the call made.

The types of line conditions detectable by the Modem are discussed in the section **Line status conditions**.

Line status conditions

After a number has been successfully dialed, one of three status conditions results: ring back, busy signal, or re-order signal.

Line condition 1 — ring back

When the Modem hears the phone ring, the message RINGING ... is displayed. Each ring cycle detected by the Modem is counted until the ringing stops. The Modem stops counting when the telephone receiver is picked up or if it has been programmed (using the *I* command) to abort a call that is not answered on a designated number of rings.

When the ringing stops, the Modem checks for carrier. When it detects the carrier, it outputs the message CONNECT. As soon as the carrier tone is received from the called modem, you can begin communications. You are now in the ON-LINE mode.

Line condition 2 — busy signal

When a busy signal is detected, the message BUSY appears on your display. The Modem disconnects from the telephone lines and returns to the OFF-LINE *waiting state* until it receives the wake-up command.

If the DIAL ATTEMPTS parameter (see **I command** in Appendix A) of the Modem is programmed for a number other than 1 (the default number), the redial sequence is activated. After the first attempt, the Modem will automatically wait for about 60 seconds, then it will seize the line, dial the number, and monitor the progress of the call.

If the line is still busy, the DCM 212 will hang up and start the process again. When the Modem is programmed for 2 dial attempts and has tried twice, but failed to complete the call, everything stops here and the Modem enters the OFF-LINE state. If programmed for more than 2 dial attempts, the Modem will wait for 60 seconds and try again. The Modem will keep trying until the attempts count is completed or until the call is completed. When the call is completed, the message CONNECT is printed to the display.

Line condition 3 — re-order tone

The re-order tone is a beeping tone the telephone company uses to tell you that something is wrong. Either your Modem's numeric data is incorrect, you dialed too fast or, for some reason, the company cannot process your call.

Dial sequence emergency shutdown command

When you discover that the Modem is dialing an incorrect telephone number, or you do not want to wait for the time out to expire after having executed the dialer command with the **X** command, you can turn OFF the dial sequence. Just enter any character. The dialer command is shut down and the Modem returns the message DISCONNECT.

Busy number redial interruption

While the Modem is in the 60-second timer delay (before making another attempt to redial a number found busy), you can interrupt the process by using the ☐*☐ wake-up sequence. The wake-up command forces the Modem into the command receptive state and aborts the busy redial mode.

Analog self-test mode

Type **Q** , then type **L** to confirm that the value of the ANALOG LOOP parameter is now changed to Y. Type **X** to execute the test command. The Modem displays CONNECT and you are in the self-test mode. Type any characters on the keyboard. If the DCM 212 is working properly, the TRANSMIT DATA and RECEIVED DATA indicators blink simultaneously and the character you typed will appear on the display. If not, there are problems with the circuit. Check all cables and connections and run the test again. To abort self-test mode, press **CTRL T** for the abort character.

ON-LINE mode abort

There are four conditions which will abort an ON-LINE status while you are in communications over the telephone lines.

- Loss of carrier
- Loss of data terminal ready (DTR)
- Reception of a long space
- Transmission of the abort character

Condition 1 — loss of carrier

The carrier is the sound you hear if you pick up the receiver while the DCM 212 is in communications with another modem. During low speed (300 bps) operation, the carrier sounds like a steady, pure tone. You can hear a change in the pitch of the tone if you type on the keyboard. In high speed operation (1200 bps), the carrier sounds like running water, or static.

Regardless of the operation speed, the tone (or noise) is the carrier signal. When the carrier signal is detected, the CD indicator on the front panel lights. If the carrier is interrupted longer than 0.3 seconds, the Modem will begin the disconnect sequence. The message NO CARRIER is displayed on your screen and the Modem goes into the ON HOOK (off-line) state.

A "loss of carrier" disconnect can result other than from being turned OFF by one of the modems. If you drop the receiver onto the telephone cradle, or shout into the handset, the noise generated may be strong enough to MASK the carrier so that the DCM 212 thinks carrier is turned OFF. Although the low speed carrier is less susceptible to noise than the high speed carrier, there is always the possibility of data errors.

Condition 2 — loss of data terminal ready (DTR)

Data terminal ready (DTR) is a protocol signal that the DCM 212 receives from your computer or terminal. It must be true (asserted) before any modem operation is allowed. If you get to this point (on-line mode), it was asserted.

DTR is defaulted ON in the Modem. This means that if your computer does not have a DTR control wire, the DCM 212 will make sure this signal is set up such that you may use the Modem. Of course, if your cable connection is incorrect and the DTR pin at the Modem is shorted out, you will never be able to get the Modem to talk.

On computers with DTR control, you can stop any function by forcing the signal to disassert.

Beware of the accidental DTR switch OFF! For example, if you decide to change a terminal feature (for example, turn ON a printer port) while you are communicating with a time-sharing service, you could switch your terminal software around to its utilities menu and, suddenly, the DCM 212 could drop its telephone connection! Some terminal (and software) systems turn OFF DTR when the system is doing utilities work.

Note: If DIP Switch 8 is set to the ON position, the DCM 212 will assume that DTR is always present.

Condition 3 — reception of a long space

A long space is a start bit that takes anywhere from a half-second to one full second to end. It is not a character, although some systems consider it to be the null (0) word with a framing error (it lasted too long before the stop bit happened along).

Serial data going to the DCM 212 over the RS-232C cable is normally in a marking state. When you press a key, a start bit is transmitted (the serial line goes spacing) for a time depending on the speed of operation. The bits which make up the word are then serially shipped to the Modem, one-by-one. These bits are marking or spacing levels, depending on the type of bit (1 or 0). The last bit to be transmitted is the stop bit and it is always a marking level.

When the DCM 212 receives a long space from the host computer which last 1.5 seconds or longer, it will go into the OFF-LINE mode and disconnect from the telephone line.

The long space is an old method that teletype machines used to say: *"Pay attention to me!!!"* Several long spaces can be strung together by multiple closures of a key (usually **BREAK**). This string of spaces can tell a modern-day modem: *"I'm all done. Go ahead and turn off."* The long space method of disconnecting a modem from the lines is known as a long space disconnect sequence.

Remember, you can turn this feature OFF with the *I* command parameters.

Condition 4 — transmission of the abort character

The abort character disconnect feature enables you to disconnect an ON-LINE DCM 212 without having to remember about long spaces or shouting into the telephone. The abort character can be used in the following manner:

If you transmit the abort character and do not transmit any other character for 3 seconds afterward, the Modem will disconnect from the telephone lines.

The abort character can be turned OFF by typing any key within that 3-second period. The *I* command parameters are set up to allow you to disable the abort character disconnect feature.

The abort character (when sent) uses long space disconnect signaling to tell the other end of the line that your Modem is about to shut down. This long space signaling is only true if you have not disabled transmission of the long space with the *I* command parameters.

Result codes

The Modem sends the result codes to report you its status or telephone line condition.

Table 3. Result Codes

Code	Meaning
?	The command input is invalid.
NO NUMBER	There's no number to be dialed in the memory.
DIALING ...	Modem is dialing the number that follows.
RINGING	Ringback tone detected.
BUSY	Busy signal detected.
REORDER TONE	Reorder tone detected.
NO ANSWER	Call was not answered after 8 ringback tones.
NO DIAL TONE	No dial tone detected.*
CONNECT	Detects carrier at 300 bps. Modem goes on line.
CONNECT 1200	Detects carrier at 1200 bps and Modem goes on line.
NO CARRIER	Does not receive carrier or lost it.
DISCONNECT	Goes on hook after connecting.
WAITING FOR RING	Modem is monitoring the telephone line for a ring signal.
RING	Detects an incoming ring signal on the telephone line.

* Modem waits for dial tone only when W (a dialer code) follows D. Refer to **D command** in Appendix A.

Hayes protocol mode operation 3

In Hayes protocol mode, commands instruct the DCM 212's operation and register values determine how the commands will be executed. The command structure is patterned from the industry standard AT-string command interface, thus making the DCM 212 Hayes-software compatible.

Command codes

All command lines in Hayes protocol mode begin with the AT (attention code) string and end with a carriage return (**ENTER**). AT must be entered in uppercase letters, but the commands following can be entered in either upper- or lowercase. When the AT command is received, the Modem will automatically set the operation speed and parity.

You can store a sequence of commands in the command buffer memory, provided the command line does not exceed the 40-character buffer capacity. These commands, however, must be entered in a "logical" order to be executed. If the command line exceeds the buffer-character limit, the Modem will not execute the commands and instead sends the ERROR result code (Table 8).

Example:

AT V1 S6=3 DP9, T(111)555-1234; **ENTER**

Now, to review the commands, one by one:

AT Beginning of command line. Places the Modem in command receptive mode.

V1 Display the verbal result code. (Refer to **Result codes** later in this section.)

S6=3 Wait 3 seconds for the dial tone (see Table 7, **Registers**).

DP9, Dial 9 with pulse dialing, then pause for 2 seconds (default value of register S8).

Hayes protocol mode operation

T Touch-tone dial the telephone number that follows.

; Return to command mode and wait for the next command.

ENTER End of the command line. Execute all commands.

The attention code AT, control characters and spaces do not take up space in the command buffer. But, the punctuation used in the telephone number to make it easier to read does take up space.

The command buffer is cleared when you input the attention code AT, reset command Z or turn OFF the power supply of the Modem.

The basic commands needed for programming the Modem in Hayes protocol mode are provided in Table 4. Table 6 lists the dialing and answering commands. For a detail explanation of each command, refer to Appendix B, **Hayes protocol reference**.

Table 4. Basic Command Codes

Code	Description	Function
AT	Attention Code	Wakes up the Modem to command receptive state. Starts the command line.
ENTER	Carriage Return	Closes the command line and executes commands. S3 defines the carriage return character.
BS	Backspace	Edits the command line by deleting characters one by one. S5 defines the backspace character.
+++	Escape Code	Returns the Modem to command mode from ON-LINE mode. S2 defines the escape code character. S12 defines the escape code guard time.
O	ON-LINE	Returns the Modem to ON-LINE mode from command mode.
Z	Reset	Resets the Modem to default condition.

Commands with parameters

Some of the commands have parameters (Table 5). The parameter value, usually 0, 1 or 2, follows the command. When the command parameter is not used, the Modem assumes a value of 0. For example, the echo command E does not echo when parameter 0 is supported. It does echo when parameter 1 is supported. E used alone is the same as E0.

Table 5. Commands with Parameter

Command Parameters		Function	Default
Q	0	Result codes ON	Defined by DIP Switch 7
	1	Result codes OFF	
V	0	Numeric result codes	Defined by DIP Switch 5
	1	Verbal result codes	
X	0	Basic result code set	X0
	1	Extended result code set	
	2	Advanced result code set Enables advanced dialing subcommands (&, + and W)	
E	0	Commands are not echoed	Defined by DIP Switch 4
	1	Echo commands	
F	0	Half duplex	F1
	1	Full duplex	
M	0	Monitor speaker always OFF	M1
	1	Monitor speaker ON until carrier-detect	
	2	Monitor speaker always ON	
C	0	Transmitter OFF	C1
	1	Transmitter ON	
H	0	ON HOOK (phone line is disconnected when not in use)	NONE
	1	OFF HOOK (phone line is connected regardless of its condition)	

Table 6. Dialing and Answering Commands

Command	Description	Function
D	Dialing	Sets the Modem to originate a telephone call. D command parameters include: 0 - 9, (), -, space, *, and #.
P	Pulse Dialing	Sets the Modem to pulse dialing mode.
T	Touch-Tone Dialing	Sets the Modem to touch-tone dialing mode.
R	Reverse Mode	Changes the Modem to answer mode automatically after a call is originated.
,	Pause	Causes the Modem to pause when dialing. Place it after the access code. Length of pause time is set by S8.
;		Returns the Modem to command mode after dialing.
A/	Repeat Command	Repeats the command line. AT nor ENTER is necessary for this command.
A	Answer Mode	Sets the Modem to answer mode immediately without waiting for a ringing signal.

Registers

Registers are used to store the parameters which control communications. Each register has variables that determine how the Modem operates or supplies information on the Modem's current condition. The DCM 212's 17 registers and the default values are shown in Table 7.

Register S0 defines the number of ringing signals before a call is answered, register S1 counts the rings, registers S2-S5 define the function key characters, registers S6-S12 are used to control function time, and register S16 is for the self-test. S13-S15 are the bit-mapped registers. With the exception of the last 3 bit registers, you can read the current value of a register or assign a new value to match the registers to your particular environment by using the command syntax.

Command syntax

Sx? Check the register value

Use this syntax to check register values. The value of each register is displayed on the screen in decimal numbers in the range 0 to 255. For example, to check the value of register S0, type:

AT S0?

On the screen, you will see —

000
OK

You can also check the values of plural registers in the same command line. To check the values of register S0 and register S7, type:

AT S0? S7?

Hayes protocol mode operation

The screen might show:

000
030
OK

Sx=n Change the register value

Use this syntax to assign or change register values. To assign the value 3 to register S0, type:

AT S0=3 **ENTER**

After changing the value, the Modem signals OK. Another syntax for changing a register value is:

AT S0	ENTER	Set the pointer to register S0.
AT ?	ENTER	Read the value of S0.
AT=3	ENTER	Assign the new value 3 to S0.

For more information on the registers, refer to Appendix B, **Hayes protocol reference**.

Table 7. Registers

Register	Range	Unit	Function	Default
S0	0-255	Ring	Defines the rings in answer mode	0*
S1	0-255	Ring	Ring counter	0
S2	0-127	ASCII code	Defines escape code character	43
S3	0-127	ASCII code	Defines CR code character	13
S4	0-127	ASCII code	Defines LF code character	10
S5	0-32, 127	ASCII code	Defines BS code character	8
S6	2-255	Seconds	Defines dial tone wait time	2
S7	1-255	Seconds	Defines carrier wait time	30
S8	0-255	Seconds	Defines pause duration for comma (Although you can input a value up to 255, the actual maximum value is 54)	2
S9	1-255	1/10 sec.	Defines carrier detect response time	6
S10	1-255	1/10 sec.	Defines carrier loss time for hang up	7
S11	50-255	Millisec.	Defines touch-tone dialing speed	70
S12	20-255	1/50 sec.	Defines escape code guard time	50
S16	0		Self-test mode OFF	0
	1		Self-test mode ON	
S13-S15			Bit-mapped registers	

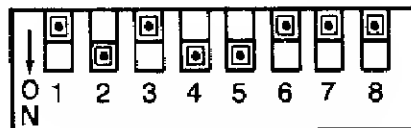
* When DIP SW1 is ON, the Modem will power up in auto answer with S0=1.

Note: The ASCII code values are expressed in decimal.

Logons in MS-DOS operating systems

With DeskMate's Telecom applications program and your Tandy personal computer, you can easily program your DCM 212 to log on to a host computer, information service or another terminal either manually or automatically. Follow the instructions in your DeskMate Tutorial and Reference manual for setting parameters and using the functions available. **Depending on the computer you are using, the procedures may differ slightly from those shown.** A Tandy 1000 Personal Computer (with an RS-232C option board) is used for the examples following.

1. Power up the computer and load your communications software. Before turning ON the Modem, set DIP switches on the DCM 212 as follows:



2. At the main menu, select Telecom and change the TELECOM-STATUS screen to show:

Autodial Modem	Yes
BAUD Rate	1200
Data Word Length	8 BITS
Parity	NONE
Number of Stop Bits	1 BIT
XON/XOFF Flow Control	OFF
ASCII Character Filter	OFF
Line Feed Filter	OFF
Echo (Half Duplex)	OFF
Redial (# of Retries)	3

3. When the DEFINE MODEM FOR COMPUTER DIALING screen appears after you selected Yes for the Autodial Modem status setting, and pressing **(F2)** change the dialing sequence to show:

PAUSE:2
SEND: ATDT

Pause for 2 seconds.
Wakeup and originate a call using touch-tone dialing

NUMBER	Send the number which will be input at terminal mode.
SEND: ^M	Send ^M to force the DCM 212 to execute the commands.
WAITC	Wait for carrier detect before continuing.

Note: If your telephone system requires pulse, rather than tone dialing, substitute an "ATDP" for the "ATDT" in the SEND line above.

4. Press **(F12)** twice to return to the TELECOM-STATUS screen after saving the dialing sequence.

Manual logon

1. Enter terminal mode from the TELECOM-STATUS screen (**(F5)**).
2. Press **(F8)** (CALL). Type in the telephone number of the information service and press **(ENTER)**.
3. After the connection has been made successfully, proceed with the logon procedures, step by step.

Automatic logon

1. At the TELECOM-STATUS screen, press **(F4)** to create an autolog file and enter your log file name, then press **(ENTER)**. Press **(F1)** to create the STATUS line. After selecting the parameters, press **(F12)** to return to the original screen and complete the rest of file. When completed, the screen for your autolog file might show:

```

STATUS: Y,12,8,N,1,OFF,OFF,OFF,OFF,3
CALL: 555-1212 (Use your local information access
PAUSE: 5          number)
SEND: ^M^M
RECV: TERMINAL=
SEND: DI^M
RECV: @
SEND: C 60942^M
RECV: ???
SEND: DJNS^M

```

2. Press **(F12)** **(ENTER)** to save this autolog file and return to the TELECOM-STATUS screen.
3. Input **(F3)** *filename* **(ENTER)** to execute your autolog file. When the logon sequence is entered correctly, the DCM 212 will dial your local access number, connect to the service, then automatically execute the rest of the autolog file.

Result codes

Result codes (Table 8) are displayed in either numeric or verbal code after the command line is executed.

Command *Q* determines whether the result codes will be displayed. When *Q1* is supported, the result codes will not be displayed. When *Q0* is supported, you can see the codes on the screen. Command *V* determines whether the result codes will be displayed as numeric (*V0*) or verbal (*V1*) codes.

The default value of these controls is fixed by DIP switches. For example, when DIP Switch 7 is set to ON, these result codes do not appear on the screen unless *Q0* is entered from the keyboard. (Refer to Chapter 1, **DIP switches**).

Another command related to the result code is the *X* command. Depending on the selected value (0, 1 or 2) of this command, the result code displayed will be from the basic, extended or advanced code set.

Result code 5 (CONNECT 1200) is used for the extended and advanced code sets. And, as shown in Table 8, the message of result code 1 (CONNECT) in the basic code set differs from its message in the extended and advanced code sets. Result codes 6-9 are displayed only when the advanced code set (value 2 is assigned to *X*) is enabled. Refer to Appendix B, **X command**.

Table 8. Result Codes

Set	Numeric	Verbal	Meaning		
ADVANCED CODE SET	EXTENDED CODE SET	BASIC CODE SET	0	OK	Executed the command line without errors.
			1	CONNECT	Basic code set. Detected carrier at 300 or 1200 bps.
					Extended and Advanced code set. Detected carrier at 300 bps.
			2	RING	Detected an incoming phone line ring signal.
			3	NO CARRIER	Carrier was lost or never heard.
			4	ERROR	Error in the command line, or the command is invalid (not recognized by the Modem), or the character format at 1200 bps is invalid, or the command line exceeds command buffer size.
			5	CONNECT 1200	Detected carrier at 1200 bps.
			4	REORDER TONE	Reorder tone detected.
			6	NO DIAL TONE	No dial tone detected.
			7	BUSY	Busy signal detected.
			8	NO ANSWER	Call was not answered after 8 ringback tones.
			9	RINGING	Ringback tone detected.

Appendices

Tandy protocol reference **A**

Wake-up command

At the initial power-up or after breaking connection with the telephone line, the Modem enters an OFF-LINE (or waiting) mode and remains in this mode until you tell (command) it what to do next.

The wake-up command opens the DCM 212 for programming and precedes any command issued to the Modem while it is in the command receptive state. This is the only command the DCM 212 will respond to while in OFF-LINE mode (from power-up). It forces the Modem from the off-line status to the command receptive state (CRS).

To send the wake-up command from your computer or terminal keyboard, press . The screen echoes:

*

You may have noticed that the * did not echo until you pressed . That's because both keys are needed to determine the speed in bits per second. When the correct speed is detected, the character * (HEX '2A') is output.

The Modem is now in the command receptive state and is waiting for you to begin programming or setting the internal switches that will tell it what operations are to be performed.

Programming commands

The list of commands that the Modem expects to receive are briefly described below. These commands can be entered either in upper- or lowercase character.

Table 9. Programming Commands

Command	Function
L, l	List user options/switches
A, a	Answer mode operation
O, o	Originate mode operation (default)
T, t	Tone dialing global command
R, r	Rotary (pulse) dialing command (default)
S, s	Slow dialing speed (default)
F, f	Fast dialing speed
Q, q	Flag for self-test
D, d	Dialer programming mode enable
@	Redefine abort character
M, m	Manual/automatic toggle command (automatic default)
G, g	Forced carrier detect toggle
E, e	Echo disable/enable command
I, i	Advanced programming feature enable
C, c	Clear memory
X, x	Exit command receptive state and execute current switches

Table 10. Valid Dialer Codes

Character Code	Description	Function
0 — 9	Digits	Dialable digit
*, #	Digits	Dialable codes
(,),-,space	Punctuation	Used to format a more readable dialing sequence
T, t	Tone flag	Dial rest using tone
R, r	Pulse flag	Dial rest using pulse
P, p	Pause flag	Delay for 2.0 seconds
W, w	Wait delay	Wait here for a dial tone
;		Return to command mode
<BS>	Back Space	Erase the last key entered

L, l List command

When the list command is entered from your computer or data terminal, the screen displays a list of the Modem's current (or defaults on start-up) parameters. Press **(L)** to send the list command. The screen echoes your command and displays:

PHONE NO:	Dialable telephone number
10 BITS/CHAR:Y	(See the note below)
ABORT CHAR:14H	HEX for Control T
LOSS OF CARR:Y	Abort on carrier loss?
SEND SPACE:N	Send space disconnect?
RECEIVE SPACE:Y	Abort on long space?
ABORT ENABLE:Y	Abort on abort char?
HIGH SPEED:Y	1200 baud mode?
ANALOG LOOP:N	Analog self-test?
ORIG MODE:Y	Originate mode?
MANUAL MODE:N	Manual mode?
FORCE CARDET:Y	Force carrier to terminal?
PULSE DIAL:Y	Default to pulse dialing?
SLOW DIAL:Y	Default to slow dialing?

Note: The second parameter 10 BITS/CHR: is not displayed when the Modem operates at 300 bps rates since the DCM 212 pays little attention to bit count during low speed operation. However, the bit count is important during 1200 bps operation since the Modem must process incoming and outgoing data.

The value of each parameter is indicated by a Yes or No response, except for the abort character setting which is a HEX value.

Seven-bit words and even or odd parity are possible. If parity is set up on your computer terminal before you send the wake-up command, the Modem will automatically correct its parity parameters. Seven-bit words with 2 stop bits are also acceptable.

On initial power-up, the list will not show an entry for PHONE NO:.. The 10 bits-per-word prompt is answered by the Modem after receiving the wake-up command code sequence. When you use 7-bit words, the 10 bits parameter shows Yes (10 BITS/CHAR:Y).

Of course, an 8-bit word with no parity is a 10-bit word (if you count the stop and start bits). If you have a computer (or terminal) which transmits 8-bit words and a parity bit (11 total bits) you will receive parity errors from the DCM 212 (that is, if it locks onto your wake-up sequence).

Each line in the parameter listing is terminated with a carriage return and a line feed. If your serial communications software automatically assumes another carriage return upon reception of a line feed code, the list will appear double-spaced.

***M, m* Manual/automatic toggle**

In manual operation mode, you can control what the system does by manually dialing and answering the phone. When you want the DCM 212 to dial a phone number or answer the phone for you, set the DCM 212 to automatic operation mode. In this mode, the DCM 212 dials the phone number you store in its memory or answers the phone when someone calls you.

When freshly powered on, the DCM 212 defaults to automatic mode operation. To change to manual mode, toggle the manual/automatic flag by pressing **(M)** for the *M* command. Then press **(L)** to see the status of this flag. The list shows:

MANUAL MODE : Y "Yes, I'm in manual mode."

Press **(M)** again and the list changes to:

MANUAL MODE : N "I'm in automatic mode."

Pressing the key again changes the parameter setting to manual mode again.

O, o Originate mode operation (default)

In this mode, the call originates from your computer. When you want to receive a call (answer the phone), set the DCM 212 to answer mode.

The Modem will always operate in originate mode when cold-started (initial power-up). Use originate mode when you want to call a time-sharing network, like CompuServe. You can also use this mode to force the Modem to automatically dial a telephone number for you (while in the automatic mode).

To check that the DCM 212 is in originate mode, enter the list command *L*. The list shows:

```
ORIG MODE:Y      "Yes, you are in originate mode."
```

A, a Answer mode operation

The *A* command places the DCM 212 in answer mode. Unless you indicate otherwise with this command, the Modem is defaulted to operate in originate mode.

Use the answer mode when you want to receive a call from a modem which is operating in originate mode. The status of the manual/automatic switch determines whether the DCM 212 will wait for the telephone to ring (auto-answer mode) or seize the telephone line as soon as you exit the command receptive state with the exit command *X* (manual answer mode).

To see how this command works, press **(A)** for the answer command, then press **(L)** to bring the parameters list to the screen. The reply line shows:

```
ORIG MODE:N
```

N indicates that the answer mode has been selected and the Modem is no longer in originate mode.

T, t Touch-tone dialing (global)

The tone command is only used when you have programmed the DCM 212 to automatically originate a call. When used here and not in the telephone number to be dialed (see "Dialer Programming mode" later in this section), this command is a global instruction. If you program the Modem to dial a telephone number, but do not specify the method for dialing, the Modem examines this global area to determine which signaling type it should use.

You can examine the global signaling type by looking in the parameter listing at the reply line. Press **(T)** for touch-tone dialing mode, then press **(L)** .

PULSE DIAL:N "No, not pulse dial. Tone dial".

R, r Rotary (pulse) dialing (default)

At initial power-up, the rotary, or pulse, signaling global command, is defaulted. This means the Modem will auto-originate a call for you using pulse signaling, unless you have specified otherwise while programming the dialer memory.

You can examine the global signaling type by looking at the listing line. Press **(R)** for rotary (pulse) dialing mode, and press **(L)** :

PULSE DIAL:Y "Yes, pulse dial."

S, s Slow dialing speed (default)

When operating in automatic originate mode, you not only have the option to select the signaling type, but also the signaling speed.

Slow signaling speed is defaulted on a freshly powered-on Modem. While in slow speed mode, the Modem pulse dials at 10 pulses per second and tone dials at 5 digits per second.

You can tell what speed rate the Modem will dial by examining the reply line:

SLOW DIAL:Y "Yes, slow dial."

F, f Fast dialing speed

If you want to tone or pulse dial using faster signaling rates, you can use the fast command. This command forces the Modem to dial while in the automatic originate mode at 10 digits per second for tone-dialing or 20 pps for pulse-dialing.

Note: The fast dialing speed command is mainly used in tone dialing. Fast pulse dialing (20 pps) is seldom used. When you experience difficulty in fast pulse dialing, set the rate to slow.

Q, q Self-test flag

The analog loop self-test mode forces the Modem to "talk to itself." The internal switches are selected such that data transmitted from the computer is looped back to the receiver and processed just as if it were in communications over the telephone lines. Keys entered from the computer are echoed to the screen.

With this feature, you will be able to tell if the Modem is functioning correctly. The analog loop self-test does not test, nor analyze, the condition of your telephone circuits, since this mode does not communicate over the lines.

The **Q** command is one of several toggling commands that the DCM 212 uses. When the power is first applied, the listing line **ANALOG LOOP:N** tells you that the Modem is not selected to go into an analog self-test mode when it exits the command receptive state with the **X** command. When the line reads **ANALOG LOOP:Y**, then the Modem is ready to enter the self-test mode upon exiting the command receptive state.

You can press **Q** as many times as you like. Each time the key is pressed, the state of the Modem's internal switch is changed from *No* to *Yes* and back again. The self-test mode does not start until the command receptive state is exited.

To exit the self-test mode, input the abort character **CTRL T**. The screen shows **DISCONNECT** and the Modem goes into **OFF-LINE** state. To return to command receptive state, enter the wake-up command *** . .**

D, d Dialer programming mode

The **D** command tells the DCM 212 that you are about to send a string of characters which are to be stored in its dialer memory. To enter the dialer programming area, press **(D)** and use the format:

DnumberX

number is the telephone number you want to dial and **X** is the command that forces the Modem out of command receptive state and to seize the phone lines and begin dialing the number.

Up to 40 characters can be entered in this dialer memory. These characters can be reviewed (use the **L** command) by looking at the first line of the Modem's parameters list after **PHONE NO:**. Of course, this space will be blank if the Modem was freshly powered on.

If you enter more than 40 characters in this memory or use an invalid character, the dialer programming mode is aborted and the Modem returns to the command receptive state.

1. To auto-dial the phone number 123-0009 (Area Code 111), press **(*) (.)** to wake up the Modem, press **(D)** to place the Modem in the dialer programming mode, then type the number:

(111)123-0009X

Digits 1,1,1,2,3,0,0,0,9 are all valid dialing codes. **X** forces the Modem to seize the telephone lines and begin dialing the phone number.

2. To auto-dial a number using touch-tone dialing at a fast speed, type:

FDT1230009X

F selects fast speed mode. **T** tells the Modem that you will be using touch-tone dialing.

3. To auto-dial the same number through a PBX with access code 9, type:

D9P123-0009X

P tells the Modem to wait 2 seconds after dialing 9 before dialing the remaining digits. Depending on your phone system, **P** can be replaced with **W**.

Valid dialer digits and codes

*0 - 9, *, and #* Dialable digits

The symbols **#** and ***** are not defined when using pulse signalling: the Modem simply ignores them.

(,), - , space

Used to format the telephone number into a more readable sequence. Each occupies 1 space in the dialer's memory, but has no function in the actual dialing.

T, R, P, W and ; Non-dialable digits

Used to control the Modem's operating features. **T** (tone flag) and **R** (pulse flag) can be used to override the global tone or pulse signaling commands already described. When the Modem sees one of these characters in the number string, it uses that type of signaling from that point on. Switching signaling types "on the fly" is useful when you are using long distance services other than from your local telephone company.

When the character **P** ("dumb pause" flag) is used in the dialing string, it delays signaling for 2.0 seconds. Afterward, signaling resumes. You can use **P** as many times as needed for longer delays.

The **W** character when used in a dial string tells the Modem to "wait here until you hear a dial tone." This character is useful when you have to dial an "outside line" code in a local exchange. Most local exchanges need a little time to get that outside line. Using **W** forces the Modem to wait until it has a valid dial tone (from the outside line) before dialing the rest of the programmed digits.

Add the semicolon to the end of the command line when transmitting information to a telephone order service or bank service that recognizes touch-tones. By inserting the semicolon, you can enter a long command line before establishing communication with another Modem.

Example:

Response	Command	Function
*	D T1(111)123-4567;X	Wake up! Originate the call by touch-tone dialing. Return to command mode.
*	D 43278 #;X	Transmit the ID number. Return to command mode.
*	D 8881 #;X	Transmit the password. Return to command mode.
*	D 273*65 #;X	Enter the transaction. Return to command mode.
*	C	Terminate the call.

BS (Backspace)

Non-dialable digit

Erases the last key stroke entered in the dialer memory. If you press **BS** and hold down the key (backspaces are auto-repeated), every digit that you entered while programming the dialer memory will be erased. As long as you do not use a non-valid character (for the dialer), you are still in the dialer program mode. Send backspace codes, then enter valid digits (123-456 9876) and the dialer memory will receive each one.

@ Redefine abort character

With this command, you can change the default abort character CTRL T into any ASCII character you like.

The abort character allows the Modem to be disconnected under software control. To program this symbol, press **@** . The next key the Modem receives will be stored as the abort character. For example, to change the abort code from CTRL T to CTRL R after doing a list command, you would type:

@ CTRL R

CTRL R would be listed as ABORT CHAR:12H (in HEX). When you enter the ASCII character, it will not be echoed on the screen. Only **@** will be echoed, provided the echo switch is not disabled.

The DCM 212 will watch for transmitter activity for 3 seconds after the abort code is sent. If there is no activity during that 3-second period, the computer will abort any ON-LINE activity in progress. If there is keyboard activity within that 3-second period, the DCM 212 will ignore the abort command.

G, g Forced carrier detect toggle

This toggling command controls the carrier detect signal applied to the computer or the terminal. When freshly powered on, the DCM 212 is commanded to force a carrier signal to your computer. If your computer does not need an asserted carrier to output RS-232C data, you can turn the carrier OFF by pressing **G** .

You can see the action of the *G* command in two ways. First, watch the Modem's front panel CD indicator go OFF and ON each time you press **G** . Next, check the parameter listing for reply line FORCE CARDET by using the *L* command to bring the list to the screen.

Note: The *G* command is effective only when the DIP SW3 is OFF.

E, e Echo disable/enable toggle

The *E* command toggle allows you to defeat or disable the Modem's echo and list ability. Normally defaulted on, the DCM 212 echoes displayable characters and generates a listing when the *L* command is received. After receiving the *E* command, the Modem will not echo nor print out its status in response to the *L* command.

The *E* command is included to allow for systems that will display serial data as soon as it is transmitted (somewhat of a half-duplex mode). Of course, since the *E* command is a toggling command, it can be used as many times as needed.

I, i **Advanced programming feature enable**

The *I* command takes you into a self-prompting menu where the Modem's advanced options are programmed. To move through this menu, press **ENTER**. If you want to change the default value of a parameter, just type in the new value. If not, press **ENTER** and the next option will appear on the screen. The list of options you will find in this menu are:

```
AUTOANS RINGS:2?  
DIAL ATTEMPTS:1?  
  ABORT RING:8?  
  LOSS OF CARR:Y?  
  SEND SPACE:N?  
RECEIVE SPACE:Y?  
  ABORT ENABLE:Y?  
  SPKR ENABLE:Y?
```

Press **1** to bring the first prompt of this menu to the screen.

When power is initially applied to the Modem, the values shown in this sub-menu are defaulted. The first prompt RETURN=NO CHG: tells you to press **ENTER** if you do not wish to change the default value of a prompt and move to the next prompt. If you want to change the value, enter the new parameter value.

AUTOANS RINGS:2?

With this option, you can change the number of rings that the DCM 212 should count before answering a ringing telephone line. This parameter is only used while the Modem is in automatic answer mode monitoring the telephone line.

Any number from 1 to 9 (including 9) is a valid parameter for this prompt. If you enter a character out of this range, the Modem questions it by printing ? and gives you a chance to re-enter your parameter.

DIAL ATTEMPTS:1?

The Modem uses this prompt to ask: "How many times do you want me to re-dial a telephone number if I cannot get through to the number?" This parameter is only scanned if the DCM 212 is operating in the automatic originate mode. You can use any number from 1 to 9 to respond.

ABORT RING:8?

This option allows you to program how long the Modem should wait for a phone to be answered that you dialed in automatic originate mode. The DCM 212 monitors the number of times the dialed phone rings and after the defaulted 8 rings, it aborts the call. You can change this parameter to any number in the range of 4 and 9 (Modem rejects any number less than 4).

LOSS OF CARR:Y?

Once the Modem is ON LINE with another computer, there are several conditions which will cause the system to disconnect from the telephone line and go into the waiting mode. One of these conditions is the loss-of-carrier disconnect sequence. This parameter prompt gives you a chance to stay on the telephone line even if carrier is disrupted.

When you do not press **ENTER** (leave alone), the prompt will wait for a Yes or No response. If the response is No, the Modem will remain connected to the telephone line even though carrier is lost.

SEND SPACE:N?

The DCM 212 informs the remote modem that you are about to exit by sending a long space. If you answer this prompt by typing Y, the Modem sends a long space over the telephone lines each time an abort character is entered. Y, N, and **ENTER** are the only valid characters for this prompt.

RECEIVE SPACE:Y?

Usually, when the Modem receives a long space from the remote modem, communication will be aborted. By entering *N*, you are commanding the Modem not to disconnect even if it receives a long space from the remote computer.

ABORT ENABLE:Y?

This parameter allows you to disable the abort character. There may be times when there are no unused characters in a file that you can use as a software abort command. So, instead of trying to invent some method of avoiding accidental disconnect, you can use this menu prompt to completely disable the function.

Note: As you can see, there are switches in the I command sub-menu which will completely disable your Modem's ability to start a disconnect sequence (abort character, a long space, and loss of carrier). If for some reason you decide to turn OFF these disconnect options, there are only two ways you can force the DCM 212 to go back ON HOOK: Turn OFF DTR or turn OFF the power switch.

SPKR ENABLE:Y?

Use this to control the ON/OFF condition of the built-in monitor speaker. Since the Modem powers up with the speaker ON, you can monitor the telephone line signal (dialing tone, ringback tone, re-order tone, busy tone, carrier tone, etc.) through the speaker during dialing mode. For quiet dialing, turn the speaker OFF by entering *N* **ENTER**. Input *Y* **ENTER** again to turn it ON.

C, c **Clear memory**

The *C* command clears the DCM 212's memory and resets all the parameters to the default values. It also clears out any telephone number you have stored in dialer memory. There is no need to follow the *C* command with the execute command *X* because the memory is cleared immediately when **C** is pressed. After this command is issued, the DCM 212 returns to OFF-LINE mode. Use the wake-up command to enter the command mode.

You can use this command when you have changed several parameters and you do not want to go back and change them again, one-by-one. It also saves you from having to cycle the power switch OFF and ON.

X, x Exit the command receptive state. Execute the current switches.

The *X* command tells the Modem that you have set up the DCM 212 the way you want it and now is the time to execute your instructions. The Modem will do one of three things:

1. Enter a waiting state and monitor the telephone lines for an incoming call (auto-answer mode).
2. Seize the telephone lines and monitor for carrier (if in manual originate or manual answer mode) or start its dialing sequence (if in auto-originate).
3. Enter the analog loop (self-test) mode in the ANALOG LOOP: Y condition.

Hayes protocol reference **B**

Programming commands

AT **Attention code**

Every command line starts with the attention code. Always enter this code in uppercase letters. Other commands may be typed in lower- or uppercase letters.

ENTER **Carriage return**

Ends the command line. The Modem does not execute a command until you press **ENTER**. The carriage return key is defined as 13 in ASCII value. To redefine it, change the value of register S3.

BS **Backspace**

You can edit a command line with the **BS** key, but the attention code at the beginning of a command line cannot be deleted. The **BS** key is defined as 8 in ASCII value. To redefine it, change the value of register S5.

+++ **Escape code**

Use the escape code to return to command mode from communications mode. When you input escape code **+++**, the Modem returns to command mode and displays the result code OK. The telephone line will still be connected until you input H0 (ON HOOK command), or Z (Reset command).

The escape code character can be redefined with register S2, and the character should be entered three consecutive times. When you redefine the escape character, do not select characters that are frequently used in the data line.

The escape code is marked off from data by the escape guard time. This guard time is inserted between the last character transmitted and the first character of the escape code. It is also inserted after the third character of the escape code. As a result, the escape code is sandwiched by the escape guard time.

The escape guard time can be redefined with register S12. Its default value is 50 (1 second). When entering the escape code with default values, wait at least 1 second, input **+++**, then wait 1 second more

before entering the command line. Without the guard time, the Modem cannot recognize the escape code.

To return on-line, enter ATO **ENTER**.

***A, a* Manual answer command**

When the *A* command is entered, the Modem goes off-hook and waits for the carrier signal. Use this command to begin computer communication immediately after talking with a friend by phone. In that case, one user should input *A* while the other uses the dial command *D*. Any command placed after *A* will not be executed. If you want to execute other commands, insert the commands before the manual answer command. For example:

AT F1 A ENTER	Wake up!
	Select full duplex.
	Wait for a carrier tone.

***D, d* Autodial command**

The *D* command sets the Modem to originate a call without using a telephone. *D* can be followed by the dialer codes shown in Table 11. When used alone, *D* sets the Modem to originate mode.

Table 11. Dialer Codes

Code	Function
0-9	Used for the telephone number
(,), -, space	Used to make the telephone number readable
*, #	Used only in touch-tone dialing
P	Sets the Modem to pulse dialing mode
T	Sets the Modem to touch-tone dialing mode
R	Changes the Modem from originate mode to answer mode once communication is established
,	Sets the Modem to pause while dialing (may be used after the access code)
;	Returns the Modem to command mode after dialing

Example:

AT DT1(111)123-0009 **ENTER** Wake up!
Originate a call by touch-tone dialing.

The result codes set selector, *X* command, is related to the dialing condition. In default condition (X0), the Modem only monitors whether a carrier signal is present after dialing the number. When you send X1 before the number, it monitors the speed of the carrier signal and sends one of two connect messages, depending on the speed. Refer to Table 12.

In the advanced dialing mode X2, the Modem monitors the dial tone, ringback tone, reorder tone, and busy signal as well as carrier and its speed. It also enables the dialing subcommands. Refer to Table 13.

The result code ON/OFF condition is determined by the *Q* command (DIP Switch 7) and the type of the code is determined by the *V* command (DIP Switch 5).

***Q, q* Result codes ON/OFF command**

Determines whether the result codes will be sent to the screen. Enter Q0 to display result codes and Q1 if the codes are not to be sent.

***V, v* Result codes mode selector**

Selects the type of result codes displayed. V0 is used for numeric codes and V1 is for verbal codes.

Note: The default values of commands *Q* and *V* are set by DIP switch.

***X, x* Result codes set selector**

Selects the basic code set X0, the extended code set X1, or the advanced code set X2. X0 and X1 differ in that the Modem informs you whether the connection has been made in 300 bps or 1200 bps. In X2 mode, the Modem enters the advanced dialing mode, and monitors telephone line condition with the subcommands enabled. Refer to **Result codes** in Chapter 3.

Table 12. Dialing Conditions in X Command Mode

Condition: Result codes=ON, Type of the code=Verbal

Dialing Mode Condition	X0 (Basic) Default	X1 (Extended)	X2 (Advanced)
Input	ATDxxxxxxx ENTER	ATX1Dxxxxxxx ENTER	ATX2Dxxxxxxx ENTER
No dial tone detected	Dials normally and waits for carrier	Same as X0 mode	Displays NO DIAL TONE and aborts dialing
Busy tone received	Displays NO CARRIER and aborts dialing after the time set by S7	Same as X0 mode	Displays BUSY and aborts dialing
Reorder tone received	Displays NO CARRIER and aborts dialing after the time set by S7	Same as X0 mode	Displays REORDER TONE and aborts dialing
Gets no answer	Displays NO CARRIER and aborts dialing after the time set by S7	Same as X0 mode	Displays NO ANSWER and aborts dialing after 8 ringbacks
No carrier detected	Displays NO CARRIER and aborts dialing	Same as X0 mode	Same as X0 mode
Connected in 300 bps	Displays CONNECT and goes on-line	Same as X0 mode	Same as X0 mode
Connected in 1200 bps	Displays CONNECT and goes on-line	Displays CONNECT 1200 and goes on-line	Same as X1 mode

Note: While in X2 mode, the Modem will disconnect after 8 ringbacks and send the message NO ANSWER. Since the carrier wait tone defined by the register S7 overrides the call-detection mode, redefine the value of S7 for a duration longer than the defaulted 30 seconds when using this feature.

Table 13. Advanced Dialing Subcommands

Code	Input Example	Function
&	ATX2D&xxxxxxx ENTER	Commands the Modem to dial out without detecting a dial tone
+	ATX2D+xxxxxxx ENTER	Overrides S6 and causes the Modem to wait 5 seconds for a dial tone
W	ATX2DxxxxxxxWxxxxxxx ENTER	Commands the Modem to hold the telephone line for 5 seconds when used between the numbers. Used to tell the Modem to wait for a dial tone from alternate long distance services, etc.

R, r **Reverse mode command**

Use this command to call and establish communication with an originate-only modem. When *R* is entered, the Modem dials the telephone number (originate mode) then enters answer mode automatically.

Example:

AT D1(111)123-0009R **ENTER** Wake up!
 Originate a call.
 Change to answer mode and wait for carrier.

P, p **Pulse dialing (default)**

The *P* command sets the Modem to pulse dialing mode. If your phone line is rotary type, input *P* at any point in the telephone number sequence. You can change to pulse dialing mode from touch-tone mode by entering ATP any time you want.

When the type of dialing (pulse or touch-tone) is not specified in the command line, the Modem defaults to the type used in the last command. Pulse dialing is fixed at 10 pps (pulses per second).

***T, t* Touch-tone dialing**

When *T* is added to the dial command, the Modem is set to touch-tone dialing mode. Use register S11 to change the speed of touch-tone dialing.

, Pause

When you use the Modem in an office or anywhere that requires an access code to get an outside telephone line, you will need to add a pause before dialing the number that follows. Insert a comma between the access code and the telephone number.

The pause duration is determined by register S8. The default pause duration of 1 comma is 2 seconds. You can accumulate the duration by using multiple commas.

; Return the Modem to command mode

Add the semicolon at the end of the command line when transmitting information to a telephone order service or bank service that recognizes touch-tones. By inserting the semicolon, you can enter a long command line before establishing communication with another modem.

Example:

Response	Command	Function
	AT D T1(111)123-4567;	Wake up! Originate the call by touch-tone dialing. Return to command mode.
OK	AT D 43278 #;	Transmit the ID number. Return to command mode.
OK	AT D 8881 #;	Transmit the password. Return to command mode.
OK	AT D 273*65 #;	Enter the transaction. Return to command mode.
OK	AT H	Terminate the call.

A/ Repeat command line

The Modem repeats the command line stored in the command buffer when the repeat command *A/* is entered. Use this command to repeat dialing when you get a busy signal or if a carrier signal is not detected.

There is no need to input the attention code *AT* or carriage return before or after the repeat command. Just enter *A/*. The repeat command is cancelled under the following conditions:

- New command line beginning with *AT* is entered
- Reset command *Z* is entered
- Modem is switched OFF

O, o On-line command

The on-line command returns the Modem to on-line mode from command mode (reverse of the escape command). Use this command to return to the on-line state after executing the local command.

Z, z Reset command

This command clears the DCM 212's command buffer and resets all commands and registers to the default values. You can use this command when you have changed the commands and registers from default condition and want to return to the default settings. It also saves you from cycling the power switch OFF and ON.

E, e Echo command

This command is used to disable or enable the command echo function. Enter *E1* to echo the command line to verify that the Modem is accurately receiving the commands sent to it. Enter *E0* when you do not want to echo the command line.

When the echo feature is disabled (*E0*), the Modem will appear dead, but actually it is working normally. The default setting of this command is set by DIP switch 4.

***F, f* Full/half duplex**

Selects full- or half-duplex communications mode. F1 sets the Modem to communicate in full-duplex mode. Use this mode to communicate with a remote system which echoes characters. F0 sets the Modem to communicate in half-duplex and is used to communicate with a remote system which does not echo characters.

***C, c* Transmitter ON/OFF command**

The C command sets the Modem's transmitter carrier signal ON or OFF. When C1 is entered, the transmitter is switched ON. The carrier signal is ON when the Modem calls, answers or connects to the remote modem; otherwise, it is OFF.

When C0 is entered, the transmitter is switched OFF. Once C0 is entered, the transmitter stays OFF until C1 or reset command Z is entered.

***H, h* Hook switch control**

Controls the hook switch of a telephone. The H0 setting is comparable to the condition of the handset resting on the hook while the telephone line is not in use. In the H1 setting, the handset is off the hook and the telephone line is in use.

Use the H0 setting for normal operation. With this setting, the Modem is connected to the telephone line automatically when the Modem originates or answers a call.

***M, m* Speaker control**

Controls the built-in speaker. Use M1 (default) to monitor a call in progress. You can monitor signals on the telephone line such as a dial tone, ring-back tone, busy signal and carrier tone. The speaker turns OFF when the Modem recognizes a carrier signal and sends a CONNECT result code.

When you want to continue monitoring the data communication, use M2 instead of M1. Or, input M0 if you do not want to use the speaker function at all.

Registers

S0 Wait for a ring before answering a call

The value of register S0 determines the number of times the phone should ring before the Modem answers a call. Input any decimal number in the range 0 to 255. If the value is set to 0, the Modem will not answer a call. Since the default value of S0 is preset at 0, use the prescribed syntax to change the value when you use the Modem in auto-answer mode. When DIP Switch 1 is ON, the Modem will power-up in auto answer with S0=1. Answer command A disregards the S0 value since it enters answer mode immediately.

S1 Counts the rings

The value of S1 increases each time the phone rings and clears if no rings occur within about 8 seconds of the last ring.

S2 Escape code definition

S2 stores the ASCII value of the escape code character. The default value is set to 43 (+). To change the escape function key, change the value using the **Sx=n** syntax. The value must be a decimal number in the range 0 to 127. If you enter a value out of this range, the escape will not work.

S3 Carriage return code definition

S3 stores the ASCII value of the carriage return character. Enter a decimal number in the range 0 to 127 when you want to change the carriage return function key. The default value is 13.

S4 Line feed code definition

S4 stores the ASCII value of the line feed character. The value is predefined as 10 (default). You can redefine the value by inputting the new ASCII character code as a line feed function key. The character is output after the carriage return only when the verbal result code (V1) is supported. The value must be a decimal number in the range 0 to 127.

S5 Backspace code definition

S5 stores the ASCII value of the backspace character code. The default value (decimal) is set to 8. To change the backspace function key, select the value between 0-32 or 127. These numbers exclude printable ASCII characters 33-126.

S6 Dial tone wait time definition

Register S6 determines the wait time for receiving a dial tone. This wait time is defined as the length of time it takes to input the first digit of the phone number after you pick up the telephone receiver. The default value is set at the minimum wait time of 2 seconds, which is regulated by the FCC. To change the wait time, input the number of seconds in the range 2 to 255.

S7 Carrier tone wait time definition

The carrier tone wait time is defined as how long the Modem can wait for a carrier tone transmitted from the remote modem. The value of S7 determines this wait time. If the Modem cannot receive a carrier tone within the restricted time, it hangs up and displays result code NO CARRIER or 3 when Q0 is supported, then returns to command mode. It is defaulted to 30 seconds. To change, input the number of seconds in the range 1 to 255.

Once the carrier tone is detected, the Modem displays CONNECT or 1 and it goes ON-LINE.

S8 Pause duration definition (for comma)

To access an outside line through a PBX or when using a special telephone service, the comma (,) is used to pause after dialing an access code. The value of register S8 determines pause duration for this comma. Defaulted to 2 seconds, it can be changed by inputting the desired number of seconds in the range 0 to 255.

S9 Carrier detect response time definition

The value of register S9 determines the length of time (carrier duration) which the Modem takes to recognize the carrier tone and send the CONNECT result code. As the value increases, the possibility of detecting a false carrier from noise decreases. The default value of S9 is fixed at 6 with the unit of 1/10 second (0.6 seconds). To change, input the desired duration in the range 1 to 255.

Note: Do NOT confuse S9 with the carrier tone wait time definition, S7.

S10 Carrier loss time definition

Register S10 decides how long the Modem waits for carrier before disconnecting the line. When the Modem does not receive a carrier tone within the time fixed by the S10 value, it disconnects the telephone line. If you set the value to 255, the Modem assumes the carrier is always present and ignores carrier detect. It is defaulted to 7 (0.7 seconds). To change, input the desired number in the range 1 to 255.

S11 Touch-tone dialing speed definition

The value of S11 defines the duration and spacing of the tones during touch-tone dialing. The default value of S11 is 70 in units of milliseconds. The minimum value for reliable dialing is 50 and the maximum value is 255.

Register S11 does not affect the pulse dialing speed; it is fixed at 10 pps.

S12 Escape code guard time definition

The value of S12 determines the escape code guard time. This escape guard time is specified to 20 minimum and 255 maximum in units of 1/50 second. The default value is 50, that is, 1 second.

Note: Beware when you are assigning a small guard time, since the guard time should be greater than the time required to transmit one of the 3 escape characters.

S16 Self-test toggle

Apply value 1 to S16 when you want to set the Modem to self-test mode. The self-test mode forces the Modem to “talk to itself.” Using this feature, you will be able to tell if the Modem is functioning correctly.

When the Modem is in self-test mode, the internal switches are selected such that data transmitted from the computer is looped back to the receiver and processed just as if it were in communications over the telephone lines. Keys entered from the computer are echoed to the screen.

Before executing a self-test, be sure to disconnect the wall jack phone line cord from the wall jack.

To set the Modem for self-test in originate mode, type:

AT S16=1 D **ENTER** Self-test mode ON.
Originate mode.

To set the Modem for self-test in answer mode, type:

AT S16=1 A **ENTER** Self-test mode ON.
Answer mode.

Bit-mapped registers

S13, S14 and S15 are the bit-mapped registers. The register bits are defined in tables 14-16.

Bit-mapped registers, which provide some useful information, may be accessed through your own program. However, do not use these registers to control the DCM 212. **Writing to bit-mapped registers may produce unpredictable results.**

S13**Table 14. Bit-mapped Register S13**

Bit	Condition	Function
0/1	0/0	Basic code set
	1/0	Undefined
	0/1	Extended code set
	1/1	Advanced code set
2	0	Parity disabled
	1	Parity enabled
3	0	Odd parity
	1	Even parity
4	0	7 data bits
	1	8 data bits
5		Undefined
6	1	Buffer overflow flag (causes ERROR result code)
7		Undefined

S14**Table 15. Bit-mapped Register S14**

Bit	Condition	Function
0	0	Auto answer disabled
	1	Auto answer enabled
1	0	Local echo disabled
	1	Local echo enabled
2	0	Result codes enabled
	1	Result codes disabled
3	0	Result codes sent as numeric
	1	Result codes sent as character
4	0	Command recognition enabled
	1	Command recognition disabled
5	0	Pulse dial
	1	Touch-tone dial
6/7	0/0	Speaker always OFF
	1/0	Speaker ON until carrier detect
	0/1	Undefined
	1/1	Speaker always ON

S15

Table 16. Bit-mapped Register S15

Bit	Condition	Function
0	0	300 bps rate
	1	1200 bps rate
1		Undefined
2	0	Answer mode
	1	Originate mode
3	0	Half-duplex
	1	Full-duplex
4/5		Undefined
6	0	Carrier OFF
	1	Carrier ON
7		Undefined

Data line monitoring

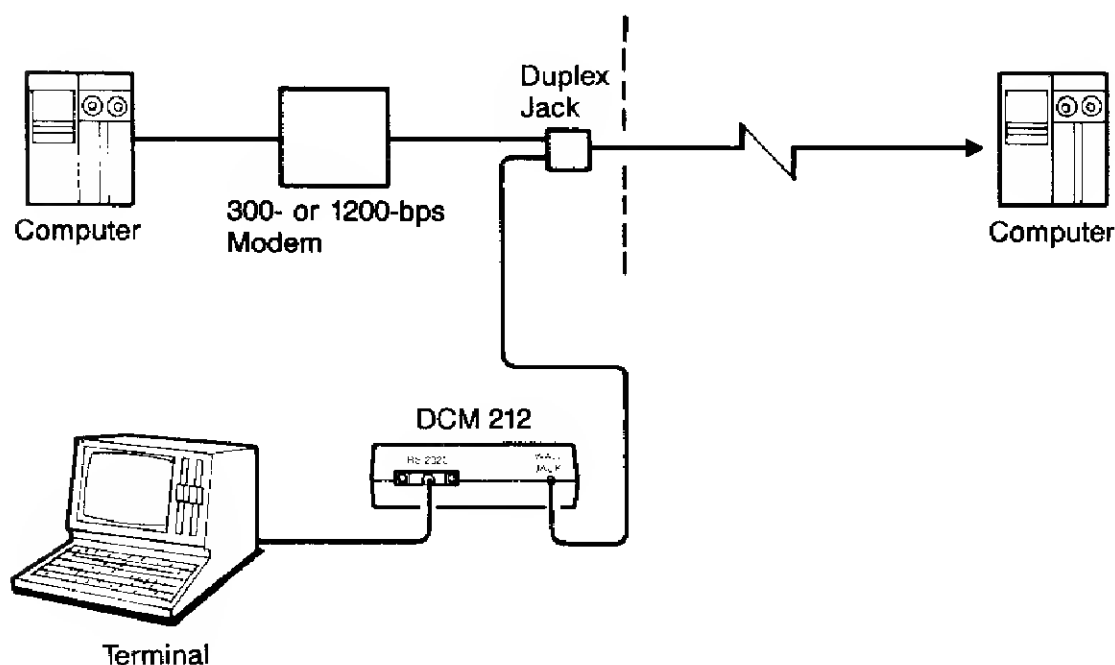
The DCM 212 can be used to monitor a data line up to 1200 bps as shown in the figure below. To accomplish this monitoring mode, the Modem's carrier transmitter should be turned off and loss of carrier condition should be ignored.

For originate mode, input:

AT C0 S10=255 D **ENTER**

For answer mode, input:

AT C0 S10=255 A **ENTER**



Connecting the DCM 212 C

Your DCM 212 is Bell system 103 and 212A compatible, connecting to the telephone lines via a modular connector. The RS-232C input/output of the Modem interfaces directly with the RS-232C-equipped Tandy computers.

Telephone connections

Please note that each product connected to the telephone line places a certain load on the line. We designate this as the unit's "Ringer Equivalence Number."

When using more than one product on the line, total all the ringer equivalence numbers. If they total more than 5, your phone may not ring. In rural areas a total of 3 may impair ringer operation. To be sure, check with your local telephone company.

The registration number as well as ringer equivalence number appears on the bottom of the unit.

The way you connect the DCM 212 to a telephone depends on how your telephone is connected to the wall.

Single-line

1. Remove your telephone's plug from the modular wall jack and insert it in the PHONE jack on the rear of the Modem.
2. Plug the Modem's WALL JACK phone line cord into the modular wall jack.

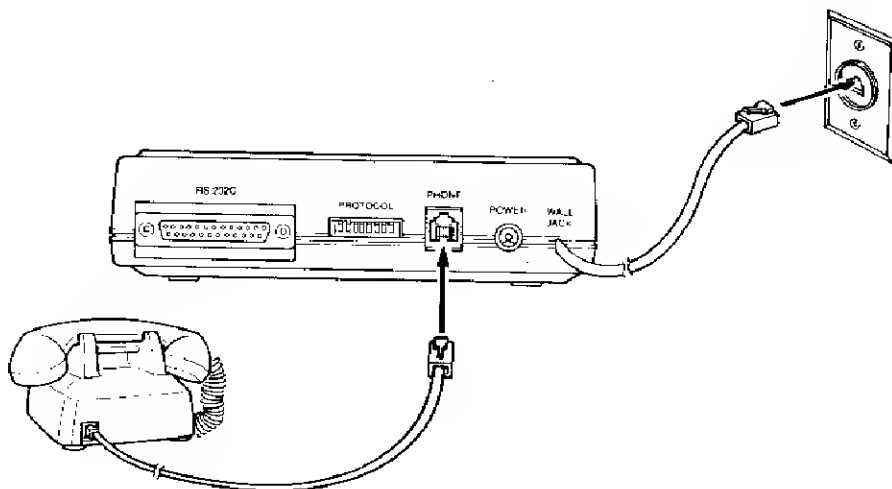


Figure 6. Modular Wall Telephone Connection

Connecting the DCM 212

If your telephone has the older style, four-prong connection, use an adapter (Radio Shack Cat. No. 279-360) to connect it to your DCM 212 as shown in Figure 7.

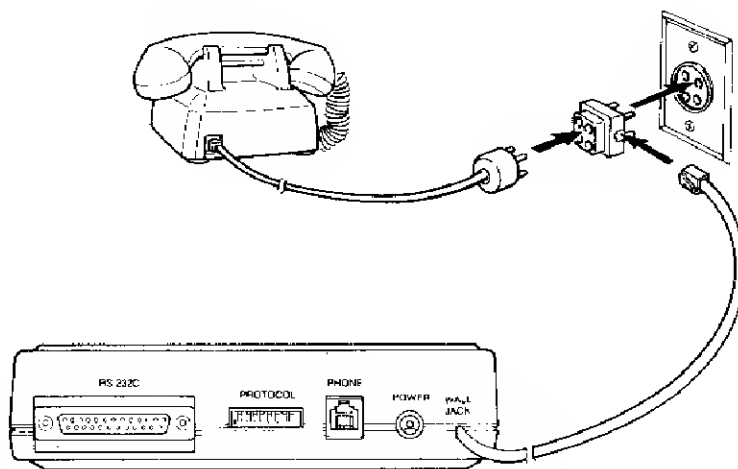


Figure 7. Connection to a Four-Prong Jack

Note: The Modem must not be connected to coin-operated phones and party-line phones.

If you plan to use the DCM 212 in automatic mode only, you do not need to use a telephone.

If your telephone is wired directly to the wall, the jacks and adapters necessary for the conversion can be purchased from your nearest Radio Shack store. Or, you may contact the telephone company to have modular connectors installed. The telephone company is authorized to charge you for the installation of such jacks. The U.S.O.C. number for the plug connection is RJ11C.

Multi-line

The DCM 212 Modem can be used with a multi-line telephone, but you may need a multi-line adapter (43-271), a hardware modification to the Modem, or both.

If you use a multi-line adapter only, the HOLD button on an extension phone can interfere with communication if someone presses it. To avoid this problem, have a qualified Radio Shack service technician modify the DCM 212.

Radio Shack has several adapters that can be used for connecting the DCM 212 to multi-line telephones. Contact your Radio Shack Computer Center or store for details.

Computer connections

The DCM 212 Modem uses the RS-232C standard serial interface cable to connect to your computer. The table below provides the cable requirement for Tandy computers. If more detailed information is needed, refer to your computer's owner's manual.

Table 17. Modem-to-Computer Cables

Computer	Cable Catalog No.
Model I	26-1145
Model III/4/4D/4P/12/16B/16B HD DT-1/DT-100/100	26-1408
Tandy 102/200/600/1000/1200/1200HD/2000/6000	26-1408
Tandy 3000	26-1399
Model II/16	26-4403

1. Plug the appropriate end of the interface cable into the RS-232C standard DB-25 jack on the rear of the Modem.
 2. Plug the other end of the cable into the computer's DB-25 jack.
- For the following computers, you'll need option boards that contain an RS-232C interface to connect your DCM 212. Contact your Radio Shack Computer Center for details.

Table 18. Computer Option Boards

Computer	Board	Catalog No.
Model I	RS-232C Interface Board with cable	26-1145
Tandy 1000	RS-232C Option Board	25-1006
Tandy 1000 EX/ 1000 SX	PLUS RS232C Upgrade Board	25-1014
Tandy 100 SX	PLUS Upgrade Adapter Board	25-1016
Tandy 1200	Captain Multifunction Board	25-3061

Color computer connections

The cable for the DCM 212-to-Color Computer connection varies with the software to be used. Select either pair from the following table.

Table 19. Color Computer Software and Cables

Communication Software	Cable Catalog No.
VIDEOTEX (26-2222)	26-3014
Deluxe RS-232 Program Pak (26-2226)	26-1408

Power source

Insert the AC adapter's plug into the AC power jack on the rear of the Modem. Plug the adapter into an electrical wall outlet or an approved power strip.

Be sure to connect the adapter to the Modem before you plug the adapter into the wall outlet. Otherwise, damage to the adapter could result.

Important Note: Use the supplied UL-listed adapter only. Another type of adapter could damage the Modem.

XENIX operations D

Your DCM 212 is configured to operate with a Tandy 6000 running the XENIX operating system (*version 3.1 or later*). This section will be helpful in explaining how using the DCM 212 with XENIX differs from operations in other modes.

When you are ready to use the Modem in XENIX, you should be familiar with the following functions: enable log-ins, disable log-ins, and dial out.

To access XENIX, you must log in as the super-user or "root" and tell the system which serial channel (A or B) you plan to use. For example, enable Channel A or B by typing:

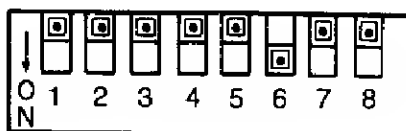
```
enable tty01 ENTER    (Enable Channel A)
      or
enable tty02 ENTER    (Enable Channel B)
```

The serial channel that is used must be disabled before using the cu command for making a call (originate mode) or "dial out." To disable a channel (A or B), type:

```
disable tty01 ENTER
      or
disable tty02 ENTER
```

Automatic answer mode

Set the DIP switches as shown below, and power up the DCM 212. From a power-on condition, the DCM 212 will power up into the call-waiting state and monitor the telephone line for an incoming call. When DTR is asserted (*when log-ins are allowed using the enable command*), the Modem will pick up the call and assume auto-answer, 10-bit word, 1200-bps operation.



Dial out

Using the DIP switch settings shown in automatic answer mode (cu command overrides DIP Switch 6), power up the DCM 212. Program the Modem to automatically dial a call by entering the cu command:

```
cu phone number -s 1200 ENTER
```

where **phone number** is the number you want dialed and the **-s** value is the baud rate selected. To dial the call out on Channel B, type:

```
cu phone number -s 1200 -a /dev/cua1 -l/dev/cul1 ENTER
```

When the prompt connected appears, you can begin communications. Refer to your XENIX system's documentation for more information on using a modem with XENIX.

Note: cu will assume tone dialing. If your phone system requires pulse (rotary) dialing, insert **r** before entering the phone number.

Optional modem configurations **E**

The DCM 212 Modem has two internal configuration options. These options must be performed by a qualified Radio Shack service technician.

- Multi-line phone operation
- RS-232 protocol extension

Multi-line phone operation

This option allows the DCM 212 Modem to be used with multi-line telephones. Internal circuitry can be configured to signal a local network that there is a MODEM on the line instead of a telephone. Unless the Modem is modified internally, the local network will start flashing the BUSY indicator on the multi-line telephone when the Modem seizes the line!

RS-232C protocol extension

There are 2 RS-232C lines that can be enabled to supply your computer with more information. These are the RI and HS lines.

The DCM 212 has the option of signaling the RS-232C cable that the telephone is ringing. The RI pin (No. 22) on the RS-232C cable will toggle at the ringing rate any time the Modem is connected to a ringing line. The HS pin (No. 12) on the RS-232 can be enabled to supply the terminal (computer) with high speed indication if the Modem switches to 1200 bps upon an ON-LINE condition.

Troubleshooting F

When you have problems transmitting data (garbled data, intermittent errors, etc.), there are a few checks you can make before taking the unit to a Radio Shack service technician:

- Phone connection is clean and noise-free.
- No one is talking on the telephone line.
- Phone and all extensions are on the hook.
- Operation speed is correct for the Modem you are using and the modem with which you are communicating.

Note: It is very unlikely . . . but if your Modem causes problems on the phone line, the telephone company has the right to temporarily discontinue your service. If this happens, the telephone company will notify you and give you a chance to have the problem corrected. Also, the telephone company has the right to make changes in their lines and/or equipment. If these changes affect your Modem or require changes in its connection, the phone company will notify you in writing so you can take the necessary steps to ensure uninterrupted service.

Maintenance

The only maintenance your DCM 212 requires is a periodic checking of cables and connections. When you experience data transfer problems, first check the cable connections. Then, run the analog loop self-test. If you still experience problems, check with your Radio Shack Computer Center or store.

Precaution

Lightning. Your DCM 212 has built-in protection circuits that meet or exceed FCC requirements to reduce risk or damage from surges in telephone line current. However, an incident such as a lightning strike near, or directly to, the telephone line may cause an excessive surge of voltage that can damage the phone device.

Lightning damage is uncommon, but can occur to phones and other electronic devices. If you are concerned about it or live in an area with frequent and/or severe electrical storms, it is suggested that you unplug the electronic products during storms.

Analog loop self-test

The analog loop self-test does not test or analyze the condition of your telephone circuits. Any keys that you press on your keyboard after sending the Q command (or S16=1 in Hayes protocol mode) are echoed to your display. This test causes the data sent from your computer to be looped back to the receiver, thus letting you know whether the Modem is functioning properly.

Performance

Operation Modes

Tandy protocol
Hayes protocol
Full or half duplex, all speeds
Automatic answer/originate
Manual answer/originate

Data Rate

Low Speed	300 bps
High Speed	1200 bps

Data Format

Serial, binary, asynchronous
Data bit: 7 with 1 or 2 stop bits; odd, even, or fixed parity
8 with 1 or 2 stop bits; no parity

Line Requirements

2-wire dial line

Line Signal

Low Speed	Frequency shift keying (FSK)
High Speed	Differential phase shift keying (DPSK)

Line Impedance

600 ohms

Modem Capability

Low Speed	Bell System 103, 300 baud FSK switched-network modems
High Speed	Bell System 212A

Data Interface

RS-232C

Pin No.	Signal	Input/Output
2	Transmit Data (TXD)	Input
3	Receive Data (RXD)	Output
5	Clear To Send (CTS)	Output
6	Data Set Ready (DSR)	Output
7	Ground	—
8	Data Carrier Detect (DCD)	Output
12	High Speed/Low Speed	Output Option
20	Data Terminal Ready (DTR)	Input
22	Ring Indicator (RI)	Output Option

Electrical

General

Transmit Level (Loop Current at 40 mA)	− 12 dBm
Transmit Frequency	
High Speed : Originate	1200 Hz
: Answer	2400 Hz
Low Speed : Originate mark	1270 Hz
space	1070 Hz
: Answer mark	2225 Hz
space	2025 Hz
Receive Sensitivity (No error) (Loop Current at 40 mA)	− 38 dBm
Carrier Sensitivity (Loop Current at 40 mA)	− 40 dBm
OFF-HOOK DC Resistance (Loop Current at 20 mA)	85 ohm

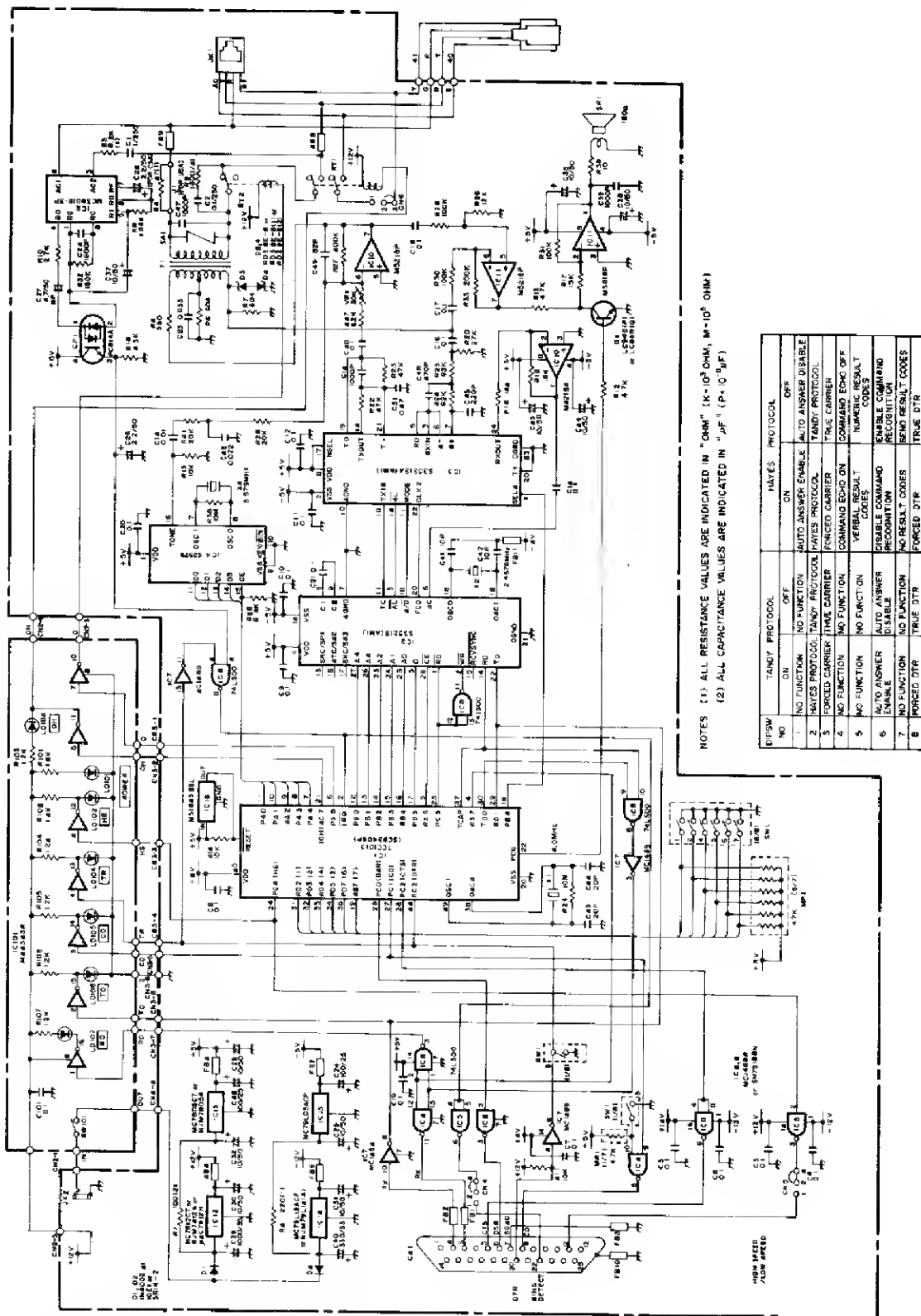
Auto Dialer

Pulse Dialing (slow)	
Pulse Rate	10 pps
Break Ratio	60 %
Interdigital Pause	800 mS
Tone Dialing (slow)	
Tone Duration	Tandy, 100 mS/ Hayes, 70 mS
Interdigital Pause	Tandy, 100 mS/ Hayes, 70 mS/

Physical/environmental

Power Requirement	120 volts AC, 60 Hz (AC adapter supplied)
Operation Temperature	55° — 85°F (12.8° — 29.4°C)
Dimension (H × W × D)	1-3/4" × 6-7/10" × 10-1/4" (45 × 170 × 260 mm)
Net Weight	25 oz (700 g)
Humidity	
Operating environment	90% relative humidity (non-condensing)
Storage	90% (non-condensing)

Schematic diagram H



NOTES (1) ALL RESISTANCE VALUES ARE INDICATED IN "OHMS" (10^3 OHMS, 10^6 OHMS)
(2) ALL CAPACITANCE VALUES ARE INDICATED IN "PF" (10^{-6} F)

DTSW	NO	TANDY PROTOCOL	HAYES PROTOCOL
1	NO FUNCTION	NO FUNCTION	AUTO ANSWER ENABLE
2	HAYES PROTOCOL	TANDY PROTOCOL	HAYES PROTOCOL
3	FORCED CARRIER	TIME CARRIER	TRUE CARRIER
4	NO FUNCTION	NO FUNCTION	COMMAND ECHO ON
5	NO FUNCTION	NO FUNCTION	VERBAL RESULT CODES
6	AUTO ANSWER DISABLE	AUTO ANSWER ENABLE	ENABLE COMMAND RECOGNITION
7	NO FUNCTION	NO FUNCTION	NO RESULT CODES
8	FORCED DTR	TRUE DTR	FORCED DTR

Schematic subject to change without notice. For most accurate Schematic (and parts) contact Radio Shack, National Parts Dept., Fort Worth TX 76102.

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